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ABSTRACT

Volume II, Section D of a six-volume final report (which covers the findings of a research project on policy and technology related to rehabilitation of disabled individuals) presents a review of literature on two types of sensory disabilities--visual and hearing impairment. Individual chapters on each disability cover the following: definitions and classifications; prevalence, incidence, mortality, and cost estimates; demographic distribution; etiology; life functioning deficits in the areas of health, mobility, communication, cognitive-intellectual functioning, and social-attitudinal functioning; functioning as members of the community and labor force; technologies currently applied; and characteristics of the delivery system impacting the disability group. Bibliographies are also provided for each disability area. (SBH)

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HUMAN REHABILITATION TECHNIQUES

A Technology Assessment

Disability Analyses Authors

Sigelman, C.
Vengroff, L.
Spanhel, C.
Mannion, C.
Schockett, M

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Volume II
Part D

Supplemental Report:
Disability Analyses
Senses Disabilities

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FOREWORD

This document is the second volume of the final report *Technology Assessment: Human Rehabilitation Techniques*, a project conducted at Texas Tech University by the Department of Industrial Engineering, the Research and Training Center in Mental Retardation, the Department of Systems, and the Technical and Professional Writing Program. The research has been conducted with the support of National Science Foundation grants ERP 75-10594 and ERP 75-10594 A01, monitored by the Directorate for Research Applications, Division of Exploratory Research and Systems Analysis.

Richard A. Dudek, Horn Professor and Chairman of the Department of Industrial Engineering has been a co-principal investigator and director of the project. Gerard J. Bensberg, Director of the Research and Training Center in Mental Retardation, and M. M. Ayoub, Professor of Industrial Engineering, have been co-principal investigators. Carol M. Sigelman and Andrew S. Martin of the Research and Training Center in Mental Retardation and Robert F. Powers of the Department of Industrial Engineering have been program managers for the project. James R. Burns and William M. Marcy of the Department of Systems have been in charge of the modeling used in the project. Technical writing has been performed by Charles W. Brewer and Cynthia E. Lyle of the Technical and Professional Writing Program. In addition, several research assistants and support personnel, as listed in the individual volumes of the study, have contributed to the project.

The project team wishes to acknowledge the efforts of individuals who have served on the Oversight Committee, Elizabeth Boggs, Kan Chen, Beatrix Cobb, Ronald Conley, Richard Herman, John Noble, Jr., Evan Vlachos, and Lester Wolcott; of Lee Phillips who served effectively as a program manager for a short time before leaving Texas Tech; of Brian Lambert who served as Work Session Conference Coordinator; of those who participated in the work-sessions chaired by Ted Hartman, David Malone, Blair Rowley, Evan Vlachos and John Wittman; and of Anne Seitz, the Secretary of the Project.

Although the National Science Foundation has supported this project, the findings, conclusions and recommendations expressed are those of the research team and do not necessarily reflect the views of NSF.

PREFACE

This volume is a supplement to the final report of the project "Technology Assessment: Human Rehabilitation Techniques." It includes reviews of the literature on 14 disabilities selected for intensive case study in the project. The contents of Volume 2 are as follows, with disabilities grouped on the basis of similarities of effects on functioning:

Section A--Motor Disabilities

Stroke	Cathy Mannion
Spinal Cord Injury	Linda Vengroff
Cerebral Palsy	Cynthia Spanhel, Linda Vengroff

Section B--Behavioral Disabilities

Epilepsy	Linda Vengroff, Melanie Schockett
Mental Retardation	Carol Sigelman, Linda Vengroff, Jerry Morris, Andrew Martin
Schizophrenia	Cynthia Spanhel, Melanie Schockett

Section C--Chronic Disease Disabilities

Rheumatoid Arthritis	Cathy Mannion, Cynthia Spanhel
Coronary Heart Disease	Cathy Mannion
Emphysema	Jody Dixon
Carcinoma of the Colon/Rectum	Linda Vengroff
Kidney Disease	Cathy Mannion, Bernadette O'Farrell Ray, Linda Vengroff
Diabetes Mellitus	Linda Vengroff

Section D--Sensory Disabilities

Visual Impairment	Melanie Schockett
Hearing Impairment	Melanie Schockett

These 14 disabilities were selected because they are prevalent, result in severe limitation, are chronic rather than acute, have survivors in need of rehabilitation, and affect a broad range of ages. The current literature on each disability was reviewed to determine: (1) definitions and classifications; (2) prevalence, incidence, mortality, and cost estimates; (3) demographic distribution; (4) etiology; (5) life functioning deficits in the areas of health, mobility, communication, cognitive-intellectual functioning, and social attitudinal functioning; (6) functioning as members of the community and labor force; (7) technologies currently applied; and (8) characteristics of the service delivery system impacting the disability group. The review papers vary in thoroughness as a function of the state of the literature about each disability and differences among the researchers doing the literature review. They reflect a first attempt at the ambitious undertaking of analyzing diverse handicapping conditions within the same analytical framework. The disability reports included in this volume provided the raw material for the cross-disability analysis reported in Working Paper 3, "Life Functions: Scope of the Problem of Disability," and in the final report Volume 1.

VOLUME 2

DISABILITY ANALYSES

VOLUME 2A - MOTOR DISABILITIES

VOLUME 2B - BEHAVIORAL DISABILITIES

VOLUME 2C - CHRONIC DISEASE DISABILITIES

VOLUME 2D - SENSES DISABILITIES

VOLUME 2D

SENSES DISABILITIES

TABLE OF CONTENTS

DISABILITY ANALYSIS: VISUAL IMPAIRMENT	CHAPTER 1
Definition	1-1
Societal Characteristics of Visaully Impaired Persons	1-4
Demographics	1-12
Etiology	1-16
Life Functions	1-18
Mobility	1-18
Health	1-22
Communication	1-22
Cognitive-Intellectual	1-27
Social Attitudinal	1-30
Functioning as a Member of Society	1-34
Technologies	1-36
Bibliography	1-38

DISABILITY ANALYSIS: HEARING IMPAIRMENT	CHAPTER 2
Definition	2-1
Societal Characteristics of Hearing Impaired Persons	2-19
Demographics	2-40
Etiology	2-48
Life Functions	2-57
Mobility	2-57
Health	2-62
Communication	2-68
Cognitive-Intellectual	2-72
Social-Attitudinal	2-82

DISABILITY ANALYSIS: HEARING IMPAIRMENT (Continued) CHAPTER 2

Functioning as a Member of Society 2-89

Technologies 2-97

Service Delivery 2-100

Bibliography 2-103

CHAPTER 1
DISABILITY ANALYSIS: VISUAL IMPAIRMENT

I. Definition

As defined in the Social Security Act of 1967,

> An individual shall be considered to be blind if he has a central visual acuity of 20/200 or less in the better eye with the use of a corrective lens. An eye which is accompanied by a limitation in the fields of vision such that the widest diameter of the visual field subtends an angle no greater than 20 degrees shall be considered for purposes of the first sentence of this subsection as having central visual acuity of 20/200 or less.

The partially sighted are generally defined as persons with a visual acuity greater than 20/200 but not greater than 20/70 in the better eye after correction. These persons are occasionally referred to as "forgotten people". Their visual loss is not so great to suggest special optical aids and yet conventional prescription lenses are inadequate for them. Patients demonstrating visual acuity that is declining as a result of any cause may well fall into this category.

"Legal blindness", of the first definition, also known as economic or industrial blindness, thus includes not only people who are totally blind, that is, unable to distinguish light from darkness or with no light perception, but those who are severely visually impaired in both eyes. By definition, then, the term blindness is not synonymous with total blindness. Some persons defined as legally blind can discern shapes and motion, and can see to travel but not to read. Some can read a few words at a time with strong lenses, but can do so for only short periods of time. Some can see to read but not to travel, while others have little restriction of activity.

Although the definition of legal blindness appears to rest on easily administered, objectively measured standards, there are great discrepancies in the test procedures used to determine who is legally blind. The Snellen Visual Acuity Chart, which is the basis of most of our examinations, measures only distance acuity, and in many cases near vision may be the critical factor in

determining reading ability and in applying for admission to schools for the blind. The chart also does not measure other components of visual performance such as uniformity of field.

The results of tests involving the Snellen Chart can be greatly influenced by the type of lighting, the exact methods of test administration, the interpretation of results, and similar subjective factors. Certainly, in making comparisons from area to area, standardized lighting, and distance parameters are urgently needed.

About 11 percent of the blind population is totally blind. The rest have some residual vision. It is important for us to know to what degree residual vision has been and can be used (visual efficiency). The Snellen Chart, taken by itself, measures primarily the ability of the individual to read a Snellen Chart. It does not indicate whether the subject has useful travel vision, reading vision, or other visual capabilities. The Snellen Chart is used, in essence, as an absolute judge when it might more appropriately be used as one tool in a more comprehensive evaluation examination. Rough Snellen guidelines of 2/200 and above for possible usable travel and reading vision, and 5/200 and above for even better usable vision are just that--rough guidelines. There is minimal correlation with visual ability and service needs. Moreover, the Snellen Chart lacks graduations between 20/200 and 20/100. It is possible that many individuals who were given an acuity of 20/200 would not have been, had there been additional line in this region. Finally, the findings in the examination approach depend on the skill of the examiner. Too often this skill is never tested (Goldstein, 1972).

That the use of the definition of legal blindness has made the administration aspects of programs easier cannot be denied, however, it is in effect, an "entry ticket" to the blindness system. A person either has vision of 20/200 or less or he does not; he is either legally blind or he is not; he is either eligible for entry into the system or he is not. Provision of the various services offered

by the system need not be governed by different criteria. On the other hand, by adhering to this definition, the system diminishes its usefulness, because it holds some people who do not need certain services to be eligible for them while excluding others who would clearly benefit from them (OSTI, 1971).

1. The definition now commonly used excludes some people who need services. For example, the Books for the Blind program of the Library of Congress excludes people who have better than 20/200 visual acuity but who nevertheless cannot read print. (This definition does not take into account near vision which is a better criterion of reading ability than is the distance vision measurement presently used.) Large-type books subsidized by federal funds are available to children within the definition who can read print but not to children with slightly better visual acuity who still need large-type books.

2. The definition dilutes the effectiveness of certain programs. For example, the Federal Aid-to-Blind-Children quota has included large-type books in recent years, which has had the effect of reducing the amount of Braille material, tactual educational aids, and tangible apparatus available for blind children who cannot use their sight in their education. As a consequence, the needs of totally blind children for books and special educational aids are not being adequately met.

3. The definition of blindness dissuades many people who come within its criteria from using valuable services and benefits, either because they do not consider themselves to be blind or do not wish others to consider them so.

4. Because the definition lumps together both the totally blind and the partially sighted, inadequate attention is given to the special problems and specialized needs of the several different groups they include.

5. The definition complicates research on all aspects of service to the blind, since the label "Blind" is applied to a group with so many diverse visual performance characteristics.

6. The definition further complicates an already complex problem of public misunderstanding of and misconceptions about blind and visually impaired persons.

7. Although the definition provides usable limits for statistical purposes, the resulting statistics may not be representative of the complete problem.

The mechanics of changing the definition have been the subject of much discussion. A classification by visual ability, which would include all people with significant visual impairment, would probably help to alleviate some of the problems listed above. Consideration of individual blind persons in terms of both their actual needs and their eligibility for specific services may also be of help (OSTI, 1971).

II. Societal Characteristics of Visually Impaired Persons

The literature provides prevalence and incidence figures for visual impairment.

At the present time it is not possible to assemble adequate and reliable statistics on blindness and vision problems in the United States as a whole. Accurate information is available in all states on the number, age, sex and racial distribution of blind persons receiving financial aid or other special services. These figures, however, do not provide reliable data on prevalence or incidence of blindness. It is not surprising, therefore, that estimates of the number of blind vary widely.

Goldstein (1972) distinguishes two approaches for securing data on severe visual impairments and blindness. The first of these is an examination approach which utilizes the legal definition of blindness, while the second is a survey approach using a functional definition.

The National Society for the Prevention of Blindness (1966) employed the former approach with estimates based on an examination-derived distance-visual criterion. The procedure for calculating the estimated rates of prevalence consisted of two main steps. The first was to determine in relative or proportional

terms the differences to be expected between the rates of respective states. Then, a probable rate is selected for one state and rates are derived for the other states from the relative numbers obtained in the first step. From the estimated rates, an estimate of the number of blind persons was found for each state, and by addition of state figure an estimate of total prevalence of blindness in the nation.

The NSPB estimate of the prevalence of legal blindness in 1960 was 385,000 or 2.14 per 1,000 population. Using the 1960 estimated prevalence rate the number of legally blind persons in 1962 was estimated as 399,300 and in 1965 as 416,400. Population projections were obtained from the U.S. Bureau of the Census so that the estimate for 1970 was 446,500 and for 1980 it was 519,200. The basic assumption underlying these estimates is that differences between the rates of blindness of states can be approximated by giving identical weights to the values for each state of three factors, namely: 1) the proportion of aged persons in the population; 2) the proportion of nonwhite population, and 3) the infant death rate, which is used for lack of a better index to represent the effectiveness of health, education and administration. It is reasonable to assume that higher rates of blindness will in general be associated with higher values for each of these factors.

Inasmuch as true incidence is unattainable because new cases of blindness are not generally reported as they occur, but rather at the time they come to the attention of the eye examiner, the Society employed an estimate of new cases reported during a given year. Their estimated rate of occurrence of new cases of blindness for 1960 was 16.9 per 100,000 population. This gave a total of 30,250 cases. The same rate was used to derive estimates of new cases for 1962 (31,350) and 1965 (32,700). Again using the Census Bureau's projections, estimates for 1970 were 35,000 and for 1980 were 41,000. It should be noted, however, that the 1960 estimated rate may not be appropriate for determining incidence

and prevalence of these later years.

The National Health Survey of the U.S. Public Health Service employed what Goldstein called the survey approach. For the purpose of the Survey, blindness was defined as the inability to read ordinary newsprint even with the aid of glasses. (Later documents were amended to read 'severely visually impaired' instead of 'blind'). The figures based on persons so enumerated are much greater than the estimated number of legally blind defined by visual acuity measurements. They conducted a nationwide household survey of a representative sample of the civilian, noninstitutionalized population on several occasions. On the basis of data collected in the period from July 1959 to June 1961, the Survey arrived at an estimated prevalence of "blindness" of 988,000 or 5.6 per 1,000 population. (Children under 6 years of age were included on the basis of a report "Blind in both eyes" or never having learned to read.) For the period July 1963-June 1964 only persons over 6 years of age were included and the estimate was 969,000 or 6.9 per 1,000. (Using all ages as the base, this figure would be 6.0. Goldstein projected the rate of 6.6 to the entire population and estimated there were 1,227,000 "blind" during this period). The estimated number of "visually impaired" persons was 5,029,000 or 31.3 per 1,000 population, while the number of persons having no vision or only light perception was about 132,000 or 0.9 per 1,000 population. A similar survey in 1971 estimated the total number of severely impaired individuals as 1,306,000 or 6.5 per 1,000 population. The total number of all visual impairments was found to be 9,596,000 or 47.4 per 1,000.

A question arises concerning the relationship between visual acuity of 20/200 or less and inability to read ordinary newsprint. Josephson and Sussman (1965) found that among those who were blind by the standard administrative definition of the term, 100 percent were unable to read newsprint; however, 62 percent of those who said that they could not read newsprint were not blind by

accepted definition, and slightly more than one-quarter of them had vision of 20/40 or better.

Another National Health Survey attempted to describe the distribution of binocular visual acuity in the civilian, noninstitutionalized population of the U.S., 18 through 79 years of age. Central visual acuity for both distance and near vision was measured for each person by means of a sight screener, a device that adopts clinical measures of visual acuity for survey research programs. According to the Binocular Visual Acuity study, for the period 1960-1962 there were an estimated 889,000 blind people. By applying this figure to the comparable population for 1965, Scott (1969) estimated there were about 900,000 blind people. Fifty-three percent of them had a corrected visual acuity poorer than 20/200; the remaining 47 percent had a corrected visual acuity of 20/200. The data of this report are one of the closest available prevalence estimates of legal blindness. Unfortunately, there are two sources of error in this study. First, there are the normal errors of sampling and nonresponse that occur in any survey study. It had been calculated that, as a result of these errors, the estimates of this study may be off by not more than 2 percent. The second source of error comes from the fact that in an undetermined number of examinations, persons with visual acuities poorer than 20/200 without correction did not have their glasses with them. When this was the case, the investigators considered the uncorrected acuity and the corrected acuity to be identical and reported them as such in the actual estimates. As a result, the figures of this survey probably overestimate the true prevalence of blindness.

The absence of uniform data on newly reported cases of blindness and on causes of blindness led to the formation of the Model Reporting Area for Blindness of the U.S. National Institute of Health. This was a new endeavour, an attempt through voluntary cooperation of states to agree on a uniform definition, on

uniform procedures for collection of data, on uniform procedures in updating registers, on uniform tabulations and on a uniform classification of causes. In the MRA figures 'blindness' means legal blindness. Data from the MRA for 1965, at which time it included 14 states, showed an incidence rate (annual rate of additions on register) of 15.8 per 100,000 population. Extrapolation to a total of 194,000,000 people yielded an estimate of 290,000 persons designated as blind (OSTI, 1971). The total number of persons on the register at the end of 1965 for all MRA states was 54,892 or about 149.4 per 100,000 population. 1970 data included 16 states and showed 99,347 persons on the register or 161.7 per 100,000 population. (Of these percent distribution by visual acuity is as follows: absolute blindness - 10.6, light perception - 11.4, light projection - 1.1, less than 5/200 - 16.0, 5/200 to less than 10/200 - 9.7, 10/200 to less than 20/200 - 15.9, 20/200 - 22.6, restricted field - 7.3, and unknown - 5.5. Note that all of these are classified as legally blind.) It was found that the 1970 total MRA annual rate of additions (15 per 100,000 population and the rate of persons on the register (162 per 100,000 population) are very similar to those reported eight years earlier when data for only nine states were available (16 and 161 per 100,000 respectively.) The development of the MRA has made the outlook for assembling accurate and reliable statistics on blindness most encouraging. As more and more states join, the true picture will become clearer.

The figure one in every 500 school children has been in general use for many years as the estimated prevalence rate for partially seeing school children. This estimate is supported by several studies, done some time ago, and data from areas making adequate provisions for special education of the partially seeing. The results from these sources range from about one per 400 to one per 1,000 school enrollment. One per 500 represents a good average and provides a conservative estimate of the problem. Using this estimate NSPB estimated there were in 1965 97,900 partially seeing school children in the U.S., not including those who are legally blind.

Duane (1965) estimated the number of Americans suffering to a greater or lesser extent from visual disability that requires corrective lenses as 90 million.

The number of blind persons in all institutions in the U.S. is undetermined. Two reports by the National Center for Health Statistics in 1963 on such institutions provide a reasonable basis for estimating the amount of blindness in the institutionalized population. According to these reports, there are estimated to be 6,143 totally blind persons in long term mental hospitals and 17,178 totally blind persons in institutions for the aged and chronically ill. An attempt was also made to estimate the number of persons who had "serious visual problems". A person was so categorized if he had a serious problem in seeing even with the aid of glasses. Some persons who were legally blind, but not totally blind, undoubtedly fell into this category. The studies estimate that there were 18,839 persons with serious visual problems in mental hospitals and 80,830 such persons in institutions for the aged and chronically ill. Using these figures, Scott (1969) estimated there were about 23,321 totally blind persons in these two types of institutions, and an additional 99,825 persons with serious visual problems.

In 1968 the Organization for Social and Technical Innovation (OSTI) a subcommittee on Rehabilitation of the National Advisory Neurological Diseases and Blindness presented the following tables of a number of different estimates of the number of blind persons.

TABLE 1-1

BLINDNESS ESTIMATED FROM VARIOUS SOURCES

Source	Prevalence Rate per 1000	Total U.S.*
NSPB Fact Book (1965)	2.1	416,000
National Health Survey (1960)	5.6	1,090,000
MRA Region Only (1965) projected to total population	1.5	290,000
Regression on MRA Using Aid to Blind, Infant Mortality and Non-White (1965)	1.6	303,000
Scott (1965)	5.5	1,077,000

*Based on total U.S. Population of 194 million

Source: OSTI, 1968

TABLE 1-2

ESTIMATED NUMBER OF BLIND PERSONS IN 1966

a. NSPB Fact Book			% of Total
YEAR		1966	
Under 65		245,000	60
65 and over		165,000	40
	Total	410,000	100
b. MRA			
YEAR		1966	
Under 65		163,000	57
65 and over		122,000	43
	Total	285,000	100
c. NHS			
YEAR		1966	
Under 65		362,000	35
65 and over		674,000	65
	Total	1,036,000	100

Population Estimates for 1966
Total U.S.A.

Under 65	179	million
65 or over	15.3	million
Total	194	million

Source: OSTI, 1968

The Future. The estimated number of cases of blindness has shown a steady upward trend since 1940. This increase is probably due to sheer increase in the population. When the estimated rates are compared it is found that the differences are not too great. Much of the increase in rates as well as in numbers is due to the increase in the proportion of older persons in the population and the greater survival of persons with disorders which may eventually lead to blindness. Thus, it is expected that the increased life span of individuals will result in increased degenerative diseases and blindness. Using U.S. statistical abstracts, 1967 and the MRA register, 1965, the OSTI (1968) projected the prevalence of blindness in 1970 as 308,800 persons and in 1980 as 386,000 persons. Along with these sources they used the data from the National Health Survey, 1963-64 and the NSPB Fact Book estimates for 1962 to project characteristics of the blind. The projections were made on a linear basis and no attempt was made to make them more sophisticated by, for example, attempting to take into consideration events which might affect the characteristics in question.

The projections indicate that there will be a 30 percent increase in the total population of blind persons during the period 1965-1985. Within this overall increase, however, there will be differential rates of growth related to various characteristics of the blind. The profile of the blind population can therefore be expected to change as follows:

1. The number of blind persons over 65 should increase by 35 percent compared with an increase of 28 percent in the number of blind under 65.

2. The number of non-white blind persons should increase by 40 percent compared with a 29 percent increase in the number of blind white persons.

3. The rates of increase of subgroups of the blind will vary according to etiology of the condition. Blindness resulting from diabetes should increase 27 percent, for example, while blindness resulting from senile degeneration should increase by 36 percent.

4. Even greater differences appear when different age groups within one etiology group are examined. In the over 65 age group, for example, decreases are projected in blindness resulting from infectious diseases and general diseases. For the 20-44 age group, on the other hand, increases of 50 to 60 percent can be expected in blindness associated with senile degeneration, vascular diseases and multiple eitiologies.

III. Demographics.

Sex: Information concerning the predominant sex of the blind is varied.

- Felton et al.(1966) state legal blindness is more prevalent in men than women.

- The 1963-64 National Health Survey found females reported an overall higher rate of visual impairment than males, particularly at the older ages. The degree of visual impairment was also greater in females.

- The Binocular Visual Acuity report (1960-62) indicates that blindness is more commonly found in women than men.

- MRA data (1969-70) show prevalence and addition rates are approximately equal for males and females both overall and for each state.

Age: - Prevalence of blindness rises steadily with age.

- Nearly one-half of the legally blind population is 65 years of age or older.

- About 50 percent of the new cases reported are 65 and over and of these 82.3% are 70 years of age or older (NSPB, 1962 data).

- Older blind persons tend to be more severely impaired than younger blind persons.

- In regard to new additions, the youngest persons entering the MRA blindness registers have the highest proportion of absolute blindness and light perception only.

Race:- Nonwhite persons report a higher prevalence rate of impaired vision than do white persons. (National Health survey).

- Degree of impairment is somewhat lower in the white population (National Health survey)

- The ratio of nonwhite to white prevalence rates increases with age to a maximum at age 45-64 and decreases thereafter (MRA 1969-70)

Region:

- The prevalence rate of vision impairment is considerably higher for the South (41.8 per 1000 population) than the Northeast (24.6), North central (26.7) and West (29.9) (National Health Survey, 1963-64)

- New York with the largest population has the highest estimated prevalence of blindness. California is a close second. Alaska, Nevada, Wyoming and Vermont are at the other end of the scale (NSPB, 1966)

- Hawaii and the District of Columbia have the highest rates of blindness (and the highest nonwhite population) (NSPB, 1966)

- The rate of new cases each year is highest for the District of Columbia and lowest for Utah (NSPB, 1966).

Education:

- Persons with less than 9 years of education report considerably higher rates of vision impairment than persons with 9 years or more of school (National Health Survey, 1963-64)

- The differences in rates between persons with 9-12 years and 13 or more years of school are very small (National Health Survey, 1963-64)

- In 1970, 12,812 blind children attended public schools and 7,951 children were enrolled in schools for the blind (American Printing House for the Blind)

Residence:

- Persons living in standard metropolitan statistical areas report the lowest rate of vision impairment.

- Among persons under 65 years of age, farm residents have the highest

prevalence rate (National Health Survey, 1963-64)

- Among persons 65 and over the highest rate was found for nonfarm residents living outside metropolitan areas. (National Health Survey, 1963-64)

- The degree of impairment differs only slightly for these three residence categories (National Health Survey,1963-64)

Income:

- The number of persons reporting vision impairment differs greatly by family income (National Health Survey, 1963-64)

- The prevalence rate per 1,000 persons with incomes under $2,000 was 92.3 compared with 15.9 for persons with incomes over $7,000.

- Persons under 65 years of age with incomes under $2,000 had a prevalence rate more than four times larger than persons in the same age group with incomes over $7,000.

- Persons 65 years of age and over in the lowest income categories reported vision impairments at a rate almost twice that of the highest income category.

- Persons with lower incomes reported a greater degree of impairment than those with higher incomes, particularly among persons under 65 years of age.

The higher prevalence of visual impairments among lower income groups cannot be explained solely by the inability of persons in the lower income groups to obtain corrective lenses. It is reasonable to assume that, at least in families where the major breadwinner is visually impaired, the impairment itself is probably a factor contributing to low income.

Limitations of Activity: Among all visually impaired persons under 65, 78.7 percent were not affected (between 1959 and 1961) in their ability to work, keep house, or go to school; 5.4% were unable to engage in the major activity of their group because of their vision; and 15.9% were partially limited (National Health Survey, 1959-1961).

- Among the males, 17 through 64 years of age, who had visual impairments, 20.9 percent were reported to be either unable to work or limited in the amount or kind of work they could do (National Health Survey, 1959-1961)

- Among the estimated 4 million persons in the population who are unable to engage in the major activity of their group because of chronic conditions, 11.1 percent (442,000) are limited to this degree because of visual impairments. The corresponding figure for persons with partial limitation is 3.9 percent (603,000) (National Health Survey, 1959-1961).

- The proportion of persons with limited activity in the visually impaired was 58.4 percent about twice that of the general population with chronic conditions (27.9). This ratio of two to one decreased with advancing age (National Health Survey, 1963-1964).

Other Handicaps:

- In a comprehensive study of multiply handicapped blind youngsters in California, it was found that more than 50 percent of the 1900 blind children surveyed were definitely classified as multiply handicapped (Lowenfeld, 1968). In 1966 Graham (1968) collected descriptive data on 8887 multiply impaired blind children and estimated that there are about 15,000 such children in the U.S.

The American Printing House for the Blind (1955) conducted a survey of multiple disabilities among children in schools for the visually impaired and found 19.6 percent of visually impaired children had one or more disabilities in addition to blindness. Mental retardation was found in 7.9 percent.

OSTI in 1968, using the data from NSPB Fact Book (1966), U.S. Statistical Abstracts (1967) and Josephson (1968) estimated there were 241,500 blind adults over 20 with one or more chronic conditions. Projecting this to 1970 and 1980 they estimated 254,000 and 320,200 respectively.

IV. Etiology

There are no reliable data on the causes of blindness for the nation as a whole. Differences in the classification schemes employed have made it impossible to compare or combine figures. The most frequently used system is probably the Standard Classification of Causes of Blindness developed by the Committee on Statistics of the Blind. It is a two-fold scheme which provides for the classification of each case according to 1) the site and type of the vision-impairing affection and 2) the general etiology or underlying cause of this affection.

The leading causes of blindness appear to be senile cataract, glaucoma, diabetes, vascular diseases and prenatal influences.

Senile cataract. NSPB estimated for 1960 that senile cataract accounts for an estimated 15.6 percent of blindness (59,980 cases). This is a degenerative disease occurring as part of the aging process. It is a condition in which the normally transparent lens becomes opaque and clouded, and makes vision difficult or impossible. It is predicted that most persons will develop cataracts if they live long enough. For only a very small proportion, however, do the cataracts progress to the point where they seriously interfere with vision. Senile cataracts cannot be prevented, but restoration of vision is successful in a vast majority of cases. (Once the cataract is mature, however, prognosis for surgical correction is not good).

Glaucoma. According to NSPB glaucoma accounts for an estimated 13.5 percent (52,010) of all cases of blindness. Nisbet (1973) estimated that 15 percent of the legally blind persons in the U.S. have glaucoma, while Feldon et al. (1966) state it accounts for 12 percent of blindness and afflicts 2 percent of the population over age 40. (All patients over age 40 are routinely tested). According to the MRA register as of December 31, 1970, the prevalence of glaucoma was estimated as 162 per 100,000 population. Glaucoma results from excessive pressure within

the eyeball (intraocular pressure). As the disease progresses the field of vision (peripheral vision) slowly diminishes until it is entirely gone unless the process is arrested. The disease process, however, is not reversible; lost vision cannot be restored. Glaucoma may be secondary to another disease, but most often it is primary. There seems to be a familial factor in its prevalence, and it occurs more commonly in women than in men.

Diabetes is now the third leading cause of blindness in the United States (NSPB, 1966, 1969). It was estimated that in 1962 diabetes accounted for 11.2 percent (42,990 cases) of the blind. According to MRA data as of December 31, 1970 prevalence of diabetic retinal disease was 6.9 per 100,000 population. Diabetes constitutes 12.7 percent of the first additions to the register in 1970 or 1,059 cases (though this probably underestimates the incidence). Using MRA data and U.S. Statistical Abstracts, OSTI estimated for 1966 32,396 cases of blindness due to diabetes. The projected number for 1970 and 1985 are 34,189 and 41,129 respectively. When they also incorporated the data from the NSPB Fact Book their estimates were somewhat higher. The most common diabetic defect is known as diabetic retinapathy, a noninflammatory disease of the retina.

Vascular Diseases, including arteriosclerosis, hypertension and nephritis account for 7.6 percent (29,130 cases) of all blindness in 1960 (NSPB Fact Book, 1966). 2.6 percent of the first additions to MRA register in 1970 were due to vascular diseases. (The number of new additions for that period was 215 cases). OSTI (1971) using U.S. statute of Abstracts and NRA data, estimated 8,303 cases in 1966 and projected 8,692 cases in 1970 and 10,922 in 1985. The majority of the cases due to vascular diseases are retinal degeneration, principally macular (the yellow spot, the small area of the retina that surrounds the fovea, a small depression in the retina, and which, with the fovea, comprises the areas of most acute vision).

Prenatal Influences. According to NSPB's 1960 data prenatal conditions were responsible for an estimated 16.7 percent (64,200 cases). Prenatal influence constitutes 14.4 percent of first addition (or 1206 cases) to MRA register of 1970. OSTI (1971) estimated 45,055 cases for 1966 and projected 47,401 and 10,922 in 1970 and 1980 respectively. Conditions in this category are those which are hereditary and those which are congenital, but whose exact cause has not been determined or is unspecified. The group includes the congenital malformations, such as coloboma and absence of all or part of the eye; congenital cataracts and glaucoma; albinism, hereditary retinal degenerations, such as retinas pigmentose. Excluded are conditions caused by prenatal infections, such as syphillis and toxoplasmosis; rubella in mother during pregnancy; and hereditary neoplasms, such as retinoblastoma.

V. Life Functions

Mobility. The restriction in the ability to get about is regarded by many as the most severe single effect of blindness. Although most blind persons who are not too old or infirm to travel are mobile, only about 30% of them are as mobile as they could be. This probably reflects the fact that only 15 percent of the blind have had mobility training. Moreover, although half of the blind travelers are dissatisfied with their travel abilities, few are taking any measures to improve them. These two facts suggest that more training programs in mobility and more publicity for existing programs may be needed rather than that present techniques are inadequate.

Most experts accept that there is a broad spectrum of need for mobility on the part of the blind. Some require a great deal of mobility and some require very little indeed. This results in quite different ways of navigating, with or without aids. Motivation, then, is an important factor in determining the mobility needs of a blind person.

A survey was conducted by the Committee on Sensory Devices in 1944 to obtain a list of objects and environmental situations considered to present serious difficulties for the blind. It seems that the informants, in assigning degree of importance to various items, were primarily concerned with the physical harm that results from inadequate adjustment when these objects are encountered. The frequency with which the objects are encountered, they considered to be of secondary importance. The items which received the unanimously highest rating, as being the most troublesome or dangerous, were: 1) crossing streets safely, 2) adequate warning of the edge of a platform 3) mail-boxes, 4) open manholes and 5) open cellar doors. Only slightly less disturbing were telephone and light poles, curbs, doors half open, pipes or ropes at head-level, stairs and differences in curbs (low on one side of the street and high on the other).

Orientation is acquired by the visually handicapped through audition (the only means by which distance and depth can be perceived) echolation (the activity of emitting a sound and perceiving the qualities of the reflected echo), tactual senses, kinesthesis (the sensitivity to muscular and joint action), vestibular sense (provides information concerning the vertical position of our body and linear and rotary components of movement, of factory sense, taste, and residual vision.

Although research evidence on the total problem is scant, one aspect of that received considerable attention: the ability of blind individuals to perceive objects in their path before they have any direct contact with the object. A research team Supa, Cotzin, & Dallenbach, 1944) at Cornell University proved convincingly that aural stimulation by reflected high frequency sonic waves is responsible for this phenomenon. Obstacle perception is most useful when the blind person moves indoors as there are less drowning-out noises.

In a study conducted by Barraga (1964) it was concluded that children with

remaining vision could improve their visual efficiency to the degree that they would be able to use their low vision more effectively for educational purposes if a planned sequence of vision stimulation were available to them in their early school years. It has been noted by many that even low degrees of vision improve mobility greatly in the blind, and thus these visual stimulation methods may be a great aid.

Good hand coordination, skill in using the body, and walking may be retarded by visual impairment. Furthermore jumping and skipping must usually be taught, since the blind child cannot learn these skills by imitation.

Finally, it has been noted that blind persons unacquainted with the rehabilitation system give very little thought to the alternatives presented by different mobility areas. Those in the blindness system will find little matching of the device to their capabilities. (The exception is in the prescription for the use of the dog guide).

Cratty (1968) and staff members of the Perceptual-Motor Learning Laboratory at the University of California, Los Angeles have conducted investigations on perceptual-motor behavior with reference to the blind. An analysis of their data revealed the following details: in the absence of auditory clues, it is predictable that a blind individual will veer about 36 degrees of angular rotation per 100 feet of forward progress; the blind are more sensitive to decline than to incline, or to left-right tilt in their walking surfaces; congenitally blind are more sensitive to gradients and veer less than older adventitiously blinded; the longer an individual has been blind the less he will tend to veer and the more accurately he can detect gradients; tactually inspecting bent wires, indicating the amount and direction of an individual's veering, can significantly reduce his veering tendency; a blind individual using the presently advocated cane techniques can successfully detect the curvature of a curb if it

TABLE 1-3

LIFE FUNCTION TABLE - VISUAL IMPAIRMENT: MOBILITY

Statement of the Problem	Dynamics	Source
Restricted in ability to get about.	About 70% of the blind, not including those too old or infirm to travel, are not as mobile as they could be.	
Insufficient numbers of training programs in mobility are available to the blind. Also, more publicity for existing programs is needed.	Blind persons dissatisifed with their travel ability.	Committee on Sensory Devices (1944)
Inadequate adjustment to hazards such as crossing streets, approaching edges of platforms, mail-boxes, open manholes and cellar doors, telephone and light poles, curbs, doors half open, pipes or ropes at head-level, stairs and differences in curbs.	Blind persons dissatisfied with their travel ability.	Jerome & Proshansky (1950)
Decreased obstacle perception outdoors due to drowning-out noises.	Persons who perceive obstacles in their path through aural stimulation.	Supa, Cotzin & Dallenbach (1944)
Unable to jump and skip.	Blind children - unable to learn these skills through imitation and must be taught.	
Decreased hand coordination and skill in using the body and walking.		
Lack of matching of mobility aid with capability of deaf person (with exception of dog guide).		
Veering tendency when walking. Insensitivity to gradient incline compared to decline.	Congenitally blind persons - this tendency decreases with length of time during which individual has been blind.	Cratty (1968)

has a radius of at least 5 feet. Those and other of their findings have important implications for mobility training.

Jerome and Proshansky (1950) examined the problem of the obstacle sense. They concluded that, "when other sources of information have been excluded, the blind person is capable of avoiding obstacles on the basis of aural clues alone "

Health. There is a higher prevalence of selected chronic conditions among visually impaired persons than among the total population. When concentrating on persons 65 years and older, visually impaired persons have more cases of hearing impairments, diabetes, vascular lesions of the central nervous system, hypertensive heart disease and general arteriosclerosis. The National Health Survey of 1963-64 reported that overall, 22.9% of the visually impaired have hearing difficulties (See Table 1-5).

The degree of vision impairment is also a factor in the number of other chronic conditions which visually impaired persons report. In the National Health Survey, greater proportions of persons with both eyes involved reported other conditions than did persons with one eye involved, and persons who could not read newsprint (severely visually impaired) reported more conditions than those who could read newsprint. (See Table 1-5).

Communication. While the visually impaired person is obviously limited in the capacity of receptive communication, the problem may be aggravated by the presence of speech and hearing defects as well.

Speech Defects. Speech deviations may be somewhat more frequent among children who are blind than sighted, although research is not in full agreement on this point. Stinchfield (1933) found, in a survey of Perkins and Overbrook residential schools for the blind, that 49% of the children evidenced some speech

TABLE 1-4

LIFE FUNCTION TABLE - VISUAL IMPAIRMENT: HEALTH

Statement of the Problem	Dynamics	Source
Higher prevalence of certain chronic conditions among visually impaired than among total population.		
More cases of hearing impairment, diabetes, vascular lesions of the central nervous system, hypertensive heart disease and general arteriosclerosis.	Persons 65 years and older.	National Health Survey (1963-64)
22.9% of visually impaired have hearing difficulties.		

TABLE 1-5

PERCENT OF PERSONS WHO REPORTED SELECTED CHRONIC CONDITIONS FOR THE TOTAL POPULATION AND FOR VISUALLY IMPAIRED PERSONS AGED 6 YEARS AND OVER, BY AGE AND DEGREE OF IMPAIRMENT: UNITED STATES, JULY 1963-JUNE 1964.

Selected chronic conditions	Total population		Visually impaired persons			
	All ages, 6+ years	65+ years	All ages, 6+ years	65+ years	Both eyes involved	One eye involved
	Percent					
Hearing impairments	5.0	20.6	22.9	34.7	28.2	16.9
Goiter or thyroid trouble	1.7	1.6	2.8	2.6	3.2	2.1
Diabetes	1.4	5.2	6.8	9.1	9.3	3.8
Anemia	0.5	1.0	1.4	1.7	1.8	0.8
Vascular lesions of the central nervous system	0.6	3.6	4.2	7.0	5.5	2.6
Selected heart diseases	2.5	11.2	9.6	13.7	12.5	6.3
Hypertensive heart disease	0.9	5.1	6.1	10.1	8.4	3.6
Hypertension without heart involvement	4.7	16.2	14.4	18.9	16.4	12.0
General arteriosclerosis	0.5	3.6	3.4	6.3	4.8	1.9

Source: National Health Survey, 1963-1964.

problems, ranging from mild oral inaccuracies and letter substitutions to lateral lisping, sigmatism (a form of stammering with imperfect pronounciation of the 's' sounds), and severe oral inaccuracies. She found more dyslalia (speech defects of organic or functional origin, dependent upon malformation or imperfect innervatim of the tongue or soft palate) than any other type of defect. Miner (1963) surveyed 293 pupils classified as blind and found 33.8% to have some speech deviation. He points out that this is four to five times higher than incidence in public schools. Articulation problems were found to be the largest category and were present in 25 percent. LeZak and Starbuck (1964) made a speech survey of 173 children and found that 49.8 percent showed some speech disorders, with 36.9 percent falling into the articulation category. Weiner (1964) found that stuttering in blind children is within the range of incidence for the general population. Practically all data on speech deviations of blind children are derived from surveys of residential school population and cannot be considered as representative of blind children in general.

Hearing defects. The register of the American Foundation for the Blind shows 372 blind children in the U.S. as of January 1, 1960. The 1964-65 rubella epidemic resulted in a dramatic increase in the population of deaf-blind children in the U.S. Salmon (1967) states that estimates of the numbers of deaf-blind people in the U.S. center around 4,000 or 5,000 - though there may be twice as many as this.

Reading: According to OSTI (1971) only about 50 percent of the blind read to any extent (even a smaller percentage of sighted people do so). As measured on reading tests, there is no significant difference between the comprehension skills of the sighted and visually handicapped children. They go on to say, "Perhaps one-quarter of all blind persons can read Braille, but only 4 percent of adults use it to any extent. If children are included, the percentage increases to 8 percent".

TABLE 1-6

LIFE FUNCTION TABLE - VISUAL IMPAIRMENT: COMMUNICATION

Statement of Problem	Dynamics	Source
Central visual acuity of 20/200 or less in the better eye after correction	characteristic of a legally defined blind individual	Social Security Act, 1967
Limitations in the field of vision	characteristic of a legally defined blind individual	" "
Visual acuity greater than 20/200 but not greater than 20/70 in the better eye after correction	characteristic of a partially blind individual	" "
Conventional prescription lenses inadequate	for those with partial vision	Goldstein, 1972
Need for special optical aids	for those with partial vision	" "
Unable to distinguish light from darkness	characteristic of those individuals judged legally blind	" "
No light perception	" "	" "
Severe visual impairment in both eyes	" "	" "
Ability to discern shapes and motion	some persons defined as legally blind	" "
Ability to see to travel but not to read	" "	" "
For a short period of time, able to read a few words with a strong lense	" "	" "
Ability to see near objects critical factor in determining reading ability		" "
Ability to see near objects critical factor in applying for schools for the blind		" "
Need for large-type books	for those with reading vision	" "

TABLE 1-6 , Cont'd

Statement of the Problem	Dynamics	Source
High incidence of speech deviations in blind children--4 to 5 times higher than in children in public schools.	33.8% of 293 blind school children surveyed had speech defects. Articulation problems in 25%.	Miner (1963) Stichfield (1933) LeZak & Starbuck (1964).
Braille is used only by about 8% of the blind population though 25% can read Braille.	This includes children as well as adults.	OSTI (1971)
Braille requires about twice as much reading time as sight reading.	4th through 8th grade.	Lowenfeld, Abel & Hatlen (1969)
49% of children in schools for blind had speech problems, with dyslabia (organic speech defects) most common.		Stirchfield (1933)
49.8% with some speech disorders, 36.9% concerning articulation.	Speech survey of 173 children.	Zak & Starbuck (1964)
High incidence of deaf-blind children - estimated 4,000 to 5,000.	Due to 1964-1965 rubella epidemic	Salmon (1967)

Lowenfeld, Abel & Hatlen (1969) investigated the Braille reading rate and found that on the fourth grade level, blind children need about twice as much time and on the eighth grade level, about one half to twice as much as seeing children.

Cognitive Intellectual. The problems in psychological evaluation of the blind are many and complex. Intelligence may be measured by sighted tests modified for the blind or tests specifically developed for the blind population. Inasmuch as modified standard intelligence tests may not be comparable to conventional test results, it is difficult to ascertain intellectual ability of the blind.

Using the Interim Hayes-Binet Test for the Blind, Hayes (1941) followed the distribution of IQ's of pupils in schools for the blind from 1915 to 1940 and found, in practically all years, a mean intelligence of slightly above 93. There were considerable variations in the percentages falling into various intelligence groups with no trend apparent in the changes over the years. The percentage in the inferior group, however, was consistently higher than that in the superior group.

Crowell (1957) summarized 19 studies in which the Hayes-Binet Intelligence Test and Wechsler Bellvue Verbal Scale were given to a total of 3,178 blind children in residential schools. Their mean IQ's were between 92 and 108, not significantly different from the average except that the distribution tended to be bimodal. It appeared that fewer blind children were of average intelligence and more were superior or inferior than the general population. Numerous other studies have reported the same conclusion.

Tillman (1967) used the WISC in evaluating the performance of blind children and concluded that 1) blind children retain experiences as facts equally well as normal children, but these experiences are less integrated and tend to stand alone; 2) blind children tend to approach abstract conceptualization problems from a concrete and functional level and consequently lag behind the sighted children; 3) for blind children vocabulary appears to be only a word-definition whereas it is much more than a word-naming function for sighted children; and 4) the blind are quite comparable to the sighted in numerical ability.

It seems generally accepted that the congenitally blind function primarily on concrete and functional-conceptual level; using abstract concepts to a far lesser degree than the sighted.

Defects in vocabulary have been reported by numerous investigators (Barriga, 1964; Nolan & Kederis, 1969). There has been much controversy over the verbal unreality or verbalisms (the use of words not verified by concrete experience) in the blind. Although inconclusive recent research does not support this concept.

Paraskera (1959) in a survey of 29 residential schools for the blind found that approximately 15 percent of the blind students were also mentally retarded. A 1965 investigation of multiply handicapped blind children in residential schools gave a prevalence ratio of 25 mentally retarded children per 100 blind children (Wolf, 1965). Retardation may be associated with the inferior environment in which many blind grow up.

Kessler (1966) writes that the blind are educationally retarded; they begin school later and read less. There seems to be some evidence that intelligence varies with the etiology of blindness, which may partially account

TABLE 1-7

LIFE FUNCTION TABLE - VISUAL IMPAIRMENT: COGNITIVE-INTELLECTUAL

Statement of the Problem	Dynamics	Source
Experiences retained as facts are inferior in integration and tend to stand alone.	Conclusions drawn from the WISC evaluating of blind children.	Tillman (1967)
Inferior ability to conceptualize vocabulary as more than a word-naming function.	Blind children	-"-
Lag in abstract conceptualization problems due to tendency to approach them from functional-conceptual and concrete level rather than abstract reasoning.	Blind children.	-"-
High prevalence ratio of MR among blind children possibly associated with inferior environment.	Blind children in schools, 15% MR. Among multiply handicapped blind in schools, 25% are mentally retarded.	Paraskera (1959); Wolf (1965)
Educational retardation due to later beginning in school and less reading than average.	Blind children	Kessler (1966)
Occurrence of subnormal IQ's and congenital abnormalities.	Persons blind due to congenital anophthalmos	Bachelis (1967)
More inferior and superior IQs among the blind, though mean IQ is about average.		Crowell (1957)
Defects in vocabulary		Barriga (1964) Nolan & Kederis (1969)

for the bimodal distribution so often found. Blindness due to congenital anophthalmos was investigated by Bachelis (1967). A majority of the cases in the study had subnormal IQ's, many of them requiring custodial care. In addition, there was a high incidence of associated handicaps and other congenital abnormalities. On the other hand, blindness due to retinoblastoma may result in selective cognitive superiority (Levitt, et al, 1972; Williams, 1968).

Social-Attitudinal Functioning In surveying the literature dealing with the emotional adjustment of the blind, one finds they are differentiated from the sighted on a number of dimensions. Various experimenters have found that the blind are more anxious, more docile, less active, more rigid, have a higher degree of intropunitiveness, a higher incidence of neurotic tendencies, and a less adequate sexual development. On the other hand, (Cowen et al, 1961) conducted a three year research program on the adjustment to blindness in adolescence and found no systematic or consistent differences in personality attributes or adjustment among visually disabled adolescents attending public day school, visually disabled adolescents from residential schools for the blind and a matched group of sighted adolescents. Lowenfeld (1973) states "The self-concepts of visually handicapped and seeing adolescents appear to be essentially similar and, in general, it can be said that there is no typical 'blind personality'. Thus, it is evident that among professionals there is little agreement in this area. Since the handicap itself influences how or with what means a person will react to his disability, research in the areas of emotional maturity, dependency, and self-concept are reviewed here.

Emotional Maturity. Zahl (1962) reports that among all the neurotic manifestations that occur with the blind, the most debilitating is inadequate emotional response. The resulting emotionally immature personality is a prime cause of the blind individual's inability to relate to co-workers and adjust on the job. It is due to this emotional immaturity, according to Cutsworth (1962), that the blind individual fails in establishing himself in his social

relationships which are seen as necessary for vocational and social success.

Dependency. Barker (1945) in his summary of various authors cited dependency conflicts as being prevalent among blind individuals because of their specific handicap. Cutsworth (1962) reported that the idea of the blind being dependent on others for functioning in the world is so widely accepted that the concept is actually taught to the blind individual in schools and rehabilitation centers specifically for the blind. Fetting (1955) in a study relating dependency to emancipation from home found that those individuals who had not graduated from a school for the blind were more successful than those who had completed training in establishing their own households outside the parental homes and in gaining meaningful associations with sighted individuals. Green (1966) found evidence that dependency in the form of "help seeking" is a concomitant condition of blindness and that this dependency generalizes to other behaviors. Imamura (1965) concluded that blind children are much more dependent than sighted children; that mothers of the blind treat their children's succorant behavior differently than mothers of sighted children by ignoring rather than refusing their children's succorant behavior; and that there is a relationship between the children's behavior and the way their mothers react to it. Succorance is the behavior characteristic tha most clearly distinguishes blind from sighted children.

Self-Concept. Cutsforth (1962) suggested that the blind individual does not live long in his social world without incorporating into his self-concept, in a greater or lesser degree, the attitudes of others toward him. Because the blind individual accepts the attitudes of society detrimental to his self-concept, he is restricted to occupations of less significance and importance, and often he does not aspire to vocational accomplishments in areas where he is fully capable. In his review of the handicapped worker, vonHaller Gilmer (1961) lends support to Cutsforth's findings. Cutsforth further suggested that this conflictual pattern is actually a greater handicap to the blind person

in social and vocational adjustment than the actual physical restrictions imposed by the blindness. As compared to sighted adolescents, Jervis (1959) found that blind individuals tended to be more apprehensive about their future, more aware of the need to get along with others, and felt less able to control outbursts of temper and aggression. Also, more of them felt that people in general did not expect enough of them. Jervis observes, that, "Blindness may be considered more than sight-deprivation but not a completely crippling factor. The fact that the blind subjects pushed either to an extreme negative or extreme positive attitude toward themselves would indicate that they have difficulty in normal adjustment."

TABLE 1-8

LIFE FUNCTION TABLE - VISUAL IMPAIRMENT: SOCIAL-ATTITUDINAL

Statement of the Problem	Dynamics	Source
Inadequate emotional response. Lessened ability to relate to co-workers and adjust to jobs.	Blind adults.	Zahl (1962)
Inferior in establishing social relationships due to emotional immaturity	Blind adults.	Cutsworth (1962)
Dependency on others for functioning in the world. Dependency conflicts and help-seeking.	This concept is actually taught to blind individuals in schools for the blind.	Cutsworth (1962) Green (1966) Fetting (1955)
Succorant behavior in blind children more pronounced than in sighted children.	Blind children.	Imamura (1965)
Acceptance of attitudes of society by blind individual which are detrimental to self-concept.	Blind adults	Cutsworth (1962)
Greater apprehension about future, and less able to control outbursts of temper and aggression than sighted adolescents.	Blind adolescents	Jervis (1959)

VI. Functioning as a Member of Society

Emotional immaturity, in some visually disabled, can result in failure to establish social relationships which are necessary for both vocational and social success (Cutsworth,1962). In addition, the integration of negative societal attitudes into the blind individual's self-concept often restricts his/her vocational aspirations (Cutsworth, 1962; vonHaller Gilmer, 1961).

However there are a number of visually impaired individuals, who are able to overcome these psychological barriers and participate more fully in the labor force. Bauman and Yoder (1962) in an investigation of blind professionals interviewed 408 persons whose visual handicaps ranged from absolute blindness to the ability to use vision on the job with the aid of special magnifying equipment. Except for persons with only minimal impairment, all these professionals required some assistance to compensate for impaired sight (such as having secretaries and wives read to them, using Braille for reading and writing, employing tape recorders, etc.). The following conclusions were made:

1. The more successful the handicapped person is in his professional activities, the less conspicuous is his need for assistance. Since people in supervisory positions customarily have subordinates to assist them, it is entirely conventional for a blind engineer, for instance, to have a staff assistant make engineering drawings for him and a secretary handle his correspondence and place his telephone calls.

2. In some of the professional activities, the visually impaired are served by persons with comparable disabilities. That is, some teachers are employed in residential schools for blind pupils or by agencies which train visually handicapped adults, while others teach sighted pupils. Similarly, some social workers are affiliated with agencies which serve the blind, but others serve the general population.

3. Many of the professional groups have responsibilities which involve travel, and the pervasive attitude among the visually handicapped is that they are willing and able to travel. Most of them undertake travel without anxiety, and report that they are entirely comfortable in requesting help when they need it.

4. Although blind persons are not admitted to medical schools, some persons who have practiced medicine and lost their sight as adults (subsequent to receiving their training) have been able to continue to treat patients. Osteopathic colleges at one time admitted blind students and a number of blind osteopaths practice successfully.

5. Among the items of specialized equipment utilized by the blind and the visually handicapped in carrying out their professional responsibilities are calculating machines with Braille dials, Braille slate and stylus, Braille stopwatches, overhead projectors in place of blackboard writing, special apparatus for taking blood pressure and temperature, Braille music and other three-dimensional reproductions of music, and a variety of files and other recordkeeping devices involving Braille attachments.

6. To the extent that a generalization can validly be made, the psychologic configuration of these persons seemed to be related more closely to sighted persons in the same profession than to others who shared their disability. For example, the teachers and social workers tended to adhere to the stereotype of being dedicated and serving, while those who wre in business tended to be energetic, decisive, and competitive.

No field of work need be totally closed to a blind person. Except for cases in which blindness is associated with mental retardation and other disabilities, the blind person is vocationally limited only by his general education, specific vocational training, and psychologic adaptation to or acceptance of disability.

VII. Technologies. THE BLIND

A. Mobility

1. Trained dog guide
2. Long cane
3. Sighted guide
4. Electronic devices

B. Communication

1. Audio techniques - Talking books, records, tapes. (Division of the Blind & Physically Handicapped of the Library of Congress).
2. Braille
3. Reading Machines - Optophone

a) Direct translation machines
b) Letter recognition machines
c) Braille system - electrified Braillewriters, high speed Braille embossors, typewriter-key-board-to-Braille embossing machines, Braille belt, line-at-a-time Braille computer programs to convert compositors' tapes to Braille.

C. Residual Vision

1. Surgery - cataract surgery, corneal transplants
2. Photo-coagulation or laser beam method for retinal holes which are not as yet detached; spot welding or closing off of retinal hole prevents retinal detachment, cyrosurgery and diathermy causes tissue scars to weld the edges of retinal holes.
3. Drugs - iodo-deoxyoridine (IDO)
4. Low vision aids - enlarge the image by optical means so that it will appear to be closer and easier to see.
5. Optical aids - help develop residual vision mechanically.
6. Near vision aids - large sized print, changes in illumination, pin-hole glasses, slits, mirrors, prisms, mydriotics and miotics to modify the pupil size.

D. Educational Programs

1. Full time special class - spend at least 3/4 of day there
2. Cooperative special class - less than 3/4 day
3. Resource room - enrolled in regular classrooms - come at special intervals.
4. Itenerant teacher - most day in regular classes but receives special instruction from itenerant teacher's who travel among two or more schools devoting more than 1/2 their time to this instruction.
5. Teacher-consultant - special teachers serve as itenerant teachers but spend at least 50% or more time in more general duties (i.e., consulting with regular school personnel, etc.)
6. Residential school - boarding facility

   Daily living skills - IHB - Industrial Home for the Blind

   (Mobility, eating skills, grooming, money counting, telephone etc.)

E. Vocational Counseling

F. Psychological Help

G. Teacher Preparation

VISUAL IMPAIRMENT BIBLIOGRAPHY

Abel, G. L. Concerning the education of blind children. New York: American Foundation for the Blind, 1959.

Abel, G. L. The blind adolescent and his need. Exceptional Children, 1961, 27, 309-311, 331-334.

Alonso, L. The educators vital role in mobility and orientation. New Outlook for the Blind, 1965, 59, 249-251.

American Foundation for the Blind Aids and appliances for the blind. New York: American Foundation for the Blind, 1968.

American Printing House for the Blind. Registration by school grades, on a Braille and large type reading as registered under the federal act to promote the education of the blind. Louisville, KY: Author, January 1970.

Bachelis, L. A. Developmental patterns of individuals with bilateral cognitive anophthalmos. New Outlook for the Blind, 1967, 61, 113-119.

Ball, M. J. Mobility in perspective. In Blindness. Washington, D.C.: American Association of Workers for the Blind, 1964.

Barker, R. G., Wright, B. A., & Gonick, M. R. Adjustment to physical handicap and illness; A survey of the social psychology of physique and disability. Social Science Research Council Bulletin, 1947, 55.

Barraga, N. Increased visual behavior in low vision children. New York: American Foundation for the Blind, 1964.

Bauman, M. K. & Yoder, N. H. Placing the blind and the visually handicapped in professional occupations. Washington, D.C.: Dept. of HEW, Office of Vocational Rehabilitation, 1962.

Best, J. P. The need for the residential school. Outlook for the Blind, 1963, 57, 127-130.

Bledsoe, C. W. For parents looking ahead to the future mobility needs of their blind children. International Journal of the Education of the Blind, 1963, 13, 13-35.

Bledsoe, C. W. The family of residential schools. In Blindness. Washington, D. C.: American Association of Workers for the Blind, 1971.

Cardona, H. Keratoprosthesis. American Journal of Opthamology, 1962, 54, 284.

Choyce, D. P. The present status of intra-cameral and intra corneal implants. Can J. Opthalmol, 1968, 3, 295.

Corchert, C. R. Blind trainees success in industry. Rehabilitation Record, 1966, 32-33.

Cowen, E. L., et al. Adjustment to visual disability in adolescence. New York: American Foundation for the Blind, 1961.

Crathy, B. J., et al. The development of perceptual motor abilities in blind children and adolescents. New Outlook for the Blind, 1968, 62, 111-117.

Cutsforth, T. D. Personality and social adjustment of the blind. In P. A. Zahl (ed.), Blindness. New York: Hafner Publishing Co., 1962.

Dog guides and blind children - a joint statement. New Outlook for the Blind, 1963, 57, 228-229.

Dowara, B. & Barraga, N. Teaching aids for blind and visually limited children. New York: American Foundation for the Blind, 1968.

Duane, T. D. Opthalmic research: JSA. New York: Research to prevent blindness, 1965.

Duane, T. D. The pros and cons of an eye institute. Blindness Annual, 1967.

Fetting, E. A. Rehabilitation status of former students. New Outlook for the Blind, 1955, 49, 21-26.

Fields, J. E. Sensory training for blind persons. New Outlook for the Blind, 1964, 58, 2-9.

Filatov, V. P. Transplantation of the cornea. Arch Ophthalmol, 1935, 13, 321.

Finestone, S. The demand for guide dogs and the travel adjustment of blind persons. Morriston, N.J.: The seeing Eye, 1960.

Finestone, S., Lukoff, I.F., & Whiteman, M. Aspects of travel adjustment of blind persons. New York: American Foundation for the Blind, 1960.

Forman, E. The inclusion of visually limited and blind children in a sighted physical education program. Education of the Visually Handicapped, 1969, 1, 113-115.

Froyd, H. E. Counseling families of severely visually handicapped children. New Outlook for the Blind, 1973, 67, 251-257.

Goldish, L. H. & Marx, M. H. The visually impaired as a market for sensory aids and services: Part two - aids and services for partially sighted persons. New Outlook for the Blind, 1973, 289-307.

Goldstein, H. Demography of blindness. In M.D. Graham (Ed.), Science and blindness: Retrospective and prospective. New York: American Foundation for the Blind, Inc., 1972.

Graham, M. D. Social research on blindness: Future station and future potentials. New York: American Foundation for the Blind, 1960.

Green, E. M. Dependent behavior in the blind adult. Unpublished doctoral dissertation, Boston University, 1966.

Hallenbeck, C. F. Curriculum standards in the U.S. for training blind persons in computer operations. New Outlook, 1973, 67, 226-271.

Harlin, R. G. Estimated prevalence of blindness in the United States and in individual states, 1960. The Sight Saving Review, 1962, 32(1).

Hayes, S. P. Contributions to a psychology of blindness. New York: American Foundation for the Blind, 1941.

Hurlin, R. G. Estimated prevalence of blindness in the United States (1952). Social Security Bulletin, July, 1953 or New Outlook for the Blind, 1953, 47(7).

The Industrial Home for the Blind The IHB Way, an approach to the rehabilitation of blind persons. Brooklyn, New York: The Industrial Home for the Blind, 1961.

Jervis, F. M. A comparison of self concepts of blind and sighted children. In C. J. Davis (Ed.), Guidance programs for blind children. Watertown, Mass.: Perkins Institution for the Blind, 1959.

Jernigan, K. The separate agency for the blind: Why and where. Braille Monitor, 1970 (July).

Josephson, E., & Sussman, M. B. A pilot study of visual impairment. New York: American Foundation for the Blind, 1965.

Kahn, H. A., & Moorehead, H. B. Statistics on blindness in the model reporting area 1969-1970. National Eye Institute. DHEW Publication No. (NIH) 73-427.

Kohn, J. The future of service by state agencies for the blind. New York: Proceedings of the National Rehabilitation Association, 1969.

Leach, F. Multiply handicapped visually impaired children: Instructional material needs. Exceptional Children, 1971.

Lesowitz, N. Characteristics of clients rehabilitated in fiscal years 1965-1969. Washington, D.C.: Division of Statestics, Social and Rehabilitation Service, 1970.

Leydhecher, W. of mass screening for glaucoma. American Journal of Opthomology, 1961, 51, 248.

LeZak, R. J., & Starbuck, H. B. Identification of children with speech disorders in a residential school for the blind. International Journal for the Education of the Blind, 1964, 14, 8-12.

Lowenfeld, B. Psychological foundation of special methods in teaching blind children. In P. A. Zahl (Ed.), Blindness, New York: Hafner Publishing Company, 1962.

Lowenfeld, B. Multi-handicapped blind children in California. Sacramento, California: California State Dept. of Education, Division of Special Serivces, 1968.

Lowenfeld, B. (Ed.) The visually handicapped child in school. New York: John Day Co., 1973.

Lowenfeld, B., Abel, G. L., & Hatten, P. N. Blind children learn to read. Springfield, Ill.: Charles C. Thomas, 1969.

Lowe, R. F. The natural history and principles of treatment of primary angle closure glaucoma. American Journal of Optholmology, 1966, 61, 642.

Lowe, R. F. Primary angle closure glaucoma: A review of provacative tests. British Journal of Opthamology, 1967, 51, 727.

McGuinnes, R. M. A descriptive study of blind children educated in the itenerant teacher, resource rooms, and special school settings. New York: American Fouincation for the Blind Research Bulletin, 1970, No. 20, 1-56.

Magers, J. Placement: Key to employment, Blindness Annual, 1966, 1971.

Maloney, E. Examining the adequacy of programming for blind children. New Outlook for the Blind, 1965, 59, 54-57.

Mann, R. W. Evaluation and simulation of mobility aids for the blind. New York: American Foundation for the Blind Research Bulletin, 1965, 11.

Maumenee, A. E. Clinical Aspects of the corneal homograft reaction. Investigative Optholmology, 1962, 1, 244.

Michaelson, I. C., & Berman, E. R. (Eds.), Causes and prevention of blindness, New York: Academic Press, 1972.

Michigan School for the Blind Curriculum guide, pre-cane mobility and orientation skills for the blind. Lansing: Michigan School for the Blind, undated.

Miner, L. E. A study of incidence of speech deviations among visually handicapped children. New Outlook for the Blind, 1963, 57, 10-14.

National Institute of Neurological Diseases and Blindness The Model Reporting Area for Blindness statistics, Annual statistical report, 1965. Biometrics Branch, National Institute of Neurological Diseases and Blindness, U.S. Dept. of HEW, Public Health Service Publication No. 1601, 1966

National Society for the Prevention of Blindness Fact Book. Estimated statistics on blindness and vision problems. New York: National Society for the Prevention of Blindness, Inc., 1966.

National Society for the Prevention of Blindness. Manual on the use of the NSPB standard classification of causes of severe vision impairment and blindness. New York: National Society for the Prevention of Blindness, Pub. # P606

Nolan, C. Y., & Kederis, C. J. Perceptual factors in braille word recognition. New York: American Foundation for the Blind, 1969.

Olsen, M. Modern curriculum provisions for visually handicapped children - A conference summary. International Journal for the Education of the Blind, 1963, 12, 80-83.

Organization for Social and Technical Innovation, Inc. Blindness and services to the blind in the United States. (A report to the subcommittee on rehabilitation. National Institute of Neurological Diseases and Blindness. Originally presented, June, 1968) Cambridge, Mass.: OSTI Press, 1971.

Payrau, M. M., & Pouliguen, J. A practical process of conversation of corneas and scleras. Bulletin of Social Opthalmology, 1959, 3, 209.

Public Health Service. Binocular visual acuity of adults, United States, 1960-1962. (U.S. National Health Survey, Publication No. 1000, Series 11, No. 03). Washington, D.C.: U.S. Dept. of Health, Education and Welfare, Public Health Service, 1964.

Public Health Service. Human communication and its disorders: An overview. (NINDS Monograph, No. 10, 1970) Washington, D.C.: U.S. Dept. of Health, Education and Welfare, Public Health Service, 1970.

Public Health Service. Prevalence of selected impairments, United States, 1971. (U.S. National Health Survey, Series 10, No. 99). Washington, D.C.: U.S. Dept. of Health, Education and Welfare, Public Health Service, 1975.

Public Health Service. Selected impairments by etiology and acuity limitation, United States, 1959-1961. (U.S. National Health Survey, Publication No. 534-B335, Series B. No. 35). Washington, D.C.: U.S. Dept of Health, Education & Welfare, Public Health Services, 1962.

Risley, B. L. The case for separate programs for the blind. In Proceedings of the National Council of Citizens Advisory Councils. Washington, D.C.: National Council of Citizens Advisory Councils, 1968.

Salzberger, R. M., & Jarrik, L. F. Intelligence tests in deal twins. In J. D. Rainer, K. Z. Altshuler, & F. J. Kallman (Eds.) Family and Mental Health Problems in a Deaf Population. Springfield, Ill.: Charles C. Thomas Publisher, 1969.

Scholl, G. T. The education of children with visual impairments. In W. Cruickshank & G. O. Johnson (Eds)., Education of exceptional children and youth. Englewood Cliffs, N.J.: Prentice Hall, 1967.

Scott, R. A. The making of blind men. New York: Russel Sage Foundation, 1969.

Seward, H. History and development of workshops for the blind in the United States. Blindness Annual, 1968.

Stalard, H. R. Eye surgery. (4th ed.) Baltimore: Williamson & Wilkins, 1965.

Stephens, T. M., & Birch, J. W. Merits of special class, resource and itinerant plans for teaching partially seeing children. Exceptional Children, 1969, 35, 481-484.

Sterling, T. D., Beriy, E. A., Pollack, S. V., & Vaughn, H. G. (Eds.), Visual prosthesis New York: Academic Press, 1971.

Stinchfield, S. M. Speech disorders. New York: Harcourt, Brace and World, Inc., 1933, pp. 62-76.

Switzer, M. E., & Bledsoe, C. W. U.S. Government sponsored research to study blindness; 1970 supplement prefaced by a composite listing of social and rehabilitation service research and demonstration projects 1954-1970. Blindness Annual, 1970.

Taylor, J. Visual Programs. In B. Lowenfeld (ed.) The visually handicapped in school. New York: John Day, 1973.

Tillman, M. H. The performance of blind and sighted children on the Wechsler Intelligence Scale for children. International Journal for the Education of the Blind, 1967, 16, 65-74, 106-112

von Haller Gilmer, B. Industrial psychology. New York: McGraw Hill, 1961.

Wagner, E. Maternal rubella: A general reaction to the disease. New Outlook for the Blind, April, 1967.

Wagner, E. Register of children with impaired vision and hearing - Statistical reports. 1966-67. New York: American Foundation for the Blind, 1970.

Waterhouse, E. J. Deaf-blind children: implications for education. Contemporary Papers, Vol. II, 1967.

Weiner, H., Dost, W., & Seibt, P. Automatic translation of inkprint to braille by electronic data processing systems. American Foundation for the Blind Research Bulletin, 1969, No. 14, 99-109.

What can we do about limited vision? Public Affairs Pamplet No. 491, New York: Public Affairs Press, 1973.

Zadnik, D. Social and medical aspects of the battered child with vision impairment. New Outlook for the Blind, 1973, 67, 241-250.

Zahl, P.A. (Ed.). Blindness. New York: Hafner Publishing Co., 1962.

CHAPTER 2
DISABILITY ANALYSIS: HEARING IMPAIRMENT

I. Definition

The absence of a legal definition of deafness points to the difficulty in defining it. Since deafness is the concern of many disciplines, each tends to introduce somewhat different factors in delineating this condition. The terms 'deaf', 'hard of hearing', 'acoustically impaired', 'auditory handicaps', etc., have different operational definitions for various investigators--and often these are not made clear in their studies. Some investigators regard deaf as only those children in school programs for the deaf, whereas others may regard as deaf only those children who do not respond to speech, even with amplification. One factor, however, in the various definitions concerning which there is general agreement is that deafness is not a disease but a functional disorder or impairment of the hearing sense due to disease, injury or genetics.

The factors concerning which there is disagreement relate to:

1. Chronicity: whether or not a hearing loss must be permanent to be included under "deafness".

2. Causal factor: whether or not the etiology of the loss has relevance to a definition of deafness, the basis of the classifications as exogenous (all factors other than heredity) and endogenous (includes only heredity).

3. Locus of the affection: whether or not deafness is to be restricted to a dysfunction of a particular portion of the auditory mechanism (such as sensorineaural, conductive, mixed, perceptive, central or cortical).

4. Age at which deafness occurred: whether or not the term deafness should be limited only to those who are mute as well as deaf, the basis of the classification as congenital (present at the time of birth) and adventitious (onset after birth).

5. Speech ability: whether or not the term deafness should be limited only to those who are mute as well as deaf.

6. "Earedness": whether or not a hearing loss which occurs in only one ear, regardless of its severity, should qualify a person as being deaf.

7. Correction: whether or not a definition of deafness should stimulate the possibilities for improving hearing with correction in view of the fact that hearing aids a) are expensive, b) require upkeep, c) do not completely compensate for a hearing loss.

8. Degree of loss: whether or not hearing loss beyond a single point on the continuum of hearing impairment should be taken as signifying deafness.

9. Measurement of hearing ability: whether or not the determination of pure tone thresholds without concomitant determination of speech reception thresholds is adequate to determine degree of hearing impairment. Two other classifications used in the study of deafness and in educational and psychological work with the hearing impaired are: a) Presbycusia: natural loss of hearing which accompanies advancement in age; and b) Deafened: profound sensorineural deafness occurring subsequent to the age at which the use of language is retained, after approximately five years of age.

Most authorities divide hearing impairments into three types (Lloyd, 1968; NINDS, 1970; & Goodhill & Guggenheim, 1971). A conductive loss or impairment is the term applied to a loss of hearing resulting from any dysfunction of the outer or middle ear--that is, one in which there is a defect in the conductive pathway of the hearing organ or anything peripheral to the round or oval window. The primary effect is a loss of perception of some degrees of noise. Perception of sounds is restored when the loudness of sounds is increased. Loss resulting from lesions of the outer or middle ear may vary from mild to moderate and rarely exceed 60 dB (ASA) or 70 dB (ISO) through the speech-frequency range. These lesions are often preventable and a considerable number respond well to medical treatment, including surgery, when discovered early. Since the neural

mechanism of the ear is unaffected, the use of a hearing aid is generally very satisfactory. A sensorineural impairment (nerve or perceptive impairment) is the term applied to a loss of hearing resulting from dysfunction of the inner ear or the nerve pathway from the inner ear to the brain stem. The primary effect is a loss of tonal clarity as well as a loss of loudness and sound. It is usually the perception of higher tones which is most affected, but when the loss is severe both high and low tones are involved. When the speech frequencies are affected, the clarity of words is distorted and intelligibility as well as awareness to sound is impaired. Since the sensory and neural mechanisms are involved, the benefits of a hearing aid may be limited. That is, the experience when using an aid may be one of increased loudness, but limited clarity. Sensorineural losses may vary from mild to total. Medical treatment can as yet do little or nothing for this type of impairment once it has become established. Prevention and early education are therefore of prime importance. A mixed hearing impairment is one in which there are defects in both areas, that is, a combination of conductive and sensorineural impairments.

Sometimes the trouble lies beyond the ear. The signals from the ear may not be reaching the brain because of trouble along the cochlear nerve, or the brain may not be properly interpreting them. Persons affected in such a way are said to have a central hearing loss. Although relatively little factual information is known concerning this disorder, the primary effect appears to be interference with the ability to perceive and interpret sound, particularly speech. Loss of loudness is not generally significant and, consequently, the decibel notation is inadequate for describing this type of impairment. Thus, central deafness is not a hearing loss problem in the same sense as the previous definitions. It is a neurological disorder for which medical treatment can do little or nothing; therefore, the value of early education cannot be overemphasized. Loudness is not a primary factor. The value of a hearing aid in this type of

hearing impairment remains controversial.

The Illinois Commission on Children (1968) employed five general classifications of hearing impaired:

1. "Slight Impairment--results in difficulty in hearing speech under less than ideal acoustic conditions. A child with a slight hearing loss will not be able to hear faint or distant speech clearly, will probably get along in school situations, and probably will not have defective speech because of the hearing loss.

2. Mild Impairment--results in some trouble understanding conversational speech at a distance of more than five feet. A child with mild loss will probably miss as much as 50% of class discussion if voices are faint or if the face is not visible. He may have defective speech if loss is of high frequency type and may have limited vocabulary.

3. Marked Impairment--results in trouble hearing speech under most conditions. Conversational speech must be loud to be understood. A child will have considerable difficulty in following classroom discussion, may exhibit deviations of articulation and voice, may misunderstand directions at times, may have limited language, and his vocabulary and usage may be affected.

4. Severe Impairment--results in inability to hear speech unless amplified in some manner. A child with severe impairment may hear a loud voice at one foot from the ear and moderate voice several inches from ear. He will be able to hear loud noises such as sirens and airplanes. His speech and language will not be learned normally without early amplification. He may be able to distinguish vowels but not all consonants even at close range.

5. Extreme (Profound) Impairment--results in inability to hear and appreciate speech by ear alone even with amplification of sound. Deafness is a profound impairment in both ears which precludes any useful hearing. A child may hear a loud shout one inch from his ear or nothing at all. He may or may not be aware of loud noises and his speech and language do not develop normally" (p. 7-8).

Most surveys have used the pure tone audiometer to determine degree of hearing loss. The pure tone frequencies which give the best estimate of speech reception are 500, 1000, and 2000 Hz. The symbol Hz stands for a unit of vibration frequency which has been adopted internationally to replace the term cycles per second. It was named after Heinrich Rudolph Hertz, the German physicist. Sensitivity to sound is expressed in decibels (or dB), a logarithmic ratio unit indicating by what proportion one intensity level differs from another. Studies prior to 1964 generally used the 1951 reference threshold which was developed by the American Standards Association (ASA). In 1964, the International Standards Organization (ISO) adopted a revised reference threshold. The American Standards Association, renamed the American National Standards Institute (ANSI) in 1969, adopted reference thresholds that approximate the 1964 ISO references (Lloyd, 1970; Melnick, 1971). Hence, in some recent studies, a reference to ANSI is given when referring to the newer threshold levels of the ISO. The following table shows the relationship of the ASA standards to the ISO and ANSI standard. As can be seen in the table, the ISO and ANSI thresholds are approximately ten decibels lower at each frequency than the older ASA thresholds. This shift was due to improved sound treated rooms, equipment, and techniques, and means that the person with average hearing can perceive a tone 10 dB lower in volume than was indicated under the previous standard (Bensberg & Sigelman, 1975).

TABLE 2-1

A COMPARISON BETWEEN ASA THRESHOLDS AND ISO THRESHOLDS

Frequency (cps or Hz)	125	250	500	1000	2000	4000
1951 ASA	54.5	39.5	25.0	16.5	17.0	15.0
1964 ISO and 1970 ANSI	45.5	24.5	11.0	6.5	8.5	9.0
dB difference	10.0	15.0	14.0	10.0	8.5	6.0

(Bensberg & Sigelman, 1975, p. 19)

Eleven states now have some type of screening program for children entering into kindergarten or first grade. Although the states vary in the criteria used when deciding whether further testing is required, generally it is a hearing loss of greater than 20 dB (ISO) in either or both ears for one or more frequency within the speech range (Bensberg & Sigelman, 1975).

There have been numerous classification systems developed in order to better categorize individuals with varying degrees of hearing loss. A simplified version of the classes of hearing handicap is presented below.

TABLE 2-2

SCALE OF HEARING HANDICAP

Hearing Level dB 1951 ASA Reference	Degree and Class of Handicap	Hearing Level dB 1964 ISO Reference
15 dB or less	NONE (A)	26 dB or less
16 - 29 dB	SLIGHT (B)	27 - 40 dB
30 - 44 dB	MILD (C)	41 - 55 dB
45 - 59 dB	MARKED (D)	56 - 70 dB
60 - 79 dB	SEVERE (E)	71 - 90 dB
80 dB or more	EXTREME (F)	91 dB or more

Source: Illinois Commission on Children, 1968, p. 19

This classification is intended primarily for statistical purposes. It is not related to the problem of medical diagnosis although it may be of medical significance. Neither can the table legitimately be used to classify children for educational purposes or for employment without other pertinent considerations. The classes of hearing handicap as defined here indicate the usual handicap of the average individual under the varying circumstances of everyday life.

The Illinois Commission on Children (1968) report also included a table relating degrees of impairment to functional limitations and educational needs.

TABLE 2-3

RELATIONSHIP OF DEGREE OF IMPAIRMENT

TO EDUCATION NEEDS

Average of the Speech Frequencies in Better Ear	Effect of Hearing Loss on the Understanding of Language and Speech	Educational Needs and Programs
Slight 16 to 29 dB (ASA) or 27 to 40 dB (ISO)	May have difficulty hearing faint or distant speech. May experience some difficulty with the language arts subjects.	Child should be reported to school principal. May benefit from a hearing aid as loss approaches 40 dB (ISO). May need attention to vocabulary development. Needs favorable seating and lighting. May need lipreading instructions. May need speech therapy.
Mild 30 to 44 dB (ASA) or 41 to 55 dB (ISO)	Understands conversational speech at a distance of 3-5 feet (face to face). May miss as much as 50% of class discussions if voices are faint or not in line of vision. May exhibit limited vocabulary and speech anomalies.	Child should be referred to special education for educational follow-up. Individual hearing aid by evaluation and training in its use. Favorable seating and possible special class placement, especially for primary children. Attention to vocabulary and reading. Lipreading instruction. Speech conservation and correction, if indicated.
Marked 45 to 59 dB (ASA) or 56 to 70 dB (ISO)	Conversation must be loud to be understood. Will have increased difficulty in group discussions. Is likely to have defective speech. Is likely to be deficient in language usage and comprehension. Will have limited vocabulary.	Child should be referred to special education for educational follow-up. Resource teacher or special class. Special help in language skills: vocabulary development, usage, reading, writing, grammar, etc. Individual hearing aid by evaluation and auditory training. Lipreading instruction. Speech conservation and correction. Attention to auditory and visual situations at all times.
Severe 60 to 79 dB (ASA) or 71 to 90 dB (ISO)	May hear loud voices about one foot from the ear. May be able to identify environmental sounds. May be able to discriminate vowels but not all consonants. Speech and language defective and likely to deteriorate.	Child should be referred to special education for educational follow-up. Full-time special program for deaf children, with emphasis on all language skills, concept development, lipreading and speech. Program needs specialized supervision and comprehensive supporting services. Individual hearing aid by evaluation. Auditory training with individual and group aids. Part-time in regular classes only as profitable.
Extreme 80 dB or more (ASA) 91 dB or more (ISO)	May hear some loud sounds but is aware of vibrations more than tonal pattern. Relies on vision rather than hearing as primary avenue for communication. Speech and language defective and likely to deteriorate.	Child should be referred to special education for educational follow-up. Full-time in special program for deaf children, with emphasis on all language skills, concept development, lipreading and speech. Program needs specialized supervision and comprehensive supporting services. Continuous appraisal of needs in regard to oral and manual communication. Auditory training with group and individual aids. Part-time in regular classes only for carefully selected children.

*Medically irreversible conditions and those requiring prolonged medical care.

(Illinois Commission on Children, 1968, p. 20).

Thus, there are many terms which refer to the deaf and hearing impaired. The Health, Education and Welfare's Advisory Committee on the Education of the Deaf (1965) presented the following definitions:

1. The hard of hearing--"those children with moderate hearing losses, who are still able to understand readily fluent speech through hearing whether or not amplification is used. Educationally speaking, these are the children who, with some assistance, are able to attend classes with normally hearing children (p. 8)."

2. The partially hearing-- "those children whose loss of hearing is so severe as to require a special educational curriculum and program of training that involves full-time auditory training along with vision for developing language and communication skills; children, who because of the severity of their loss of hearing, need the full-time services of a special teacher for their education. There are children, who, as a result of early identification of hearing loss and early auditory training, are able to progress academically at a somewhat more rapid rate than those classified as deaf by virtue of more efficient use of their residual hearing (p. 8)."

3. The deaf--"those children whose principal source for learning language and communication skills is mainly visual and whose loss of hearing, with or without amplification, is so great that it is of little or no practical value in learning to understand verbal communication auditorially, and whose loss of hearing was acquired prelingually (p. 8)."

Berg (1970) p. 7, identified the hard of hearing, deaf, and normal hearing child as follows:

"The hard of hearing child is a hearing impaired individual who can identify through hearing and without visual receptive communication enough of the distinguishing features of speech to permit at least partial recognition of the spoken language. With the addition of visual receptive communication such as speech reading, he may understand even more language provided the vocabulary

and syntax are a part of his linguistic code.

The deaf child is a hearing impaired person who can identify through hearing at best only a few of the prosodic and phonetic features of speech and then not enough to permit auditory recognition of sound or word combinations. He relies mainly or entirely upon speech reading or some other form of visual receptive communication for the perception of the spoken or manual form of language. Provided the communicative content is within his linguistic code, he understands language in many instances. His linguistic code typically is less developed than that of a hard of hearing child.

The normal hearing child, in contrast to either a hard of hearing or deaf child, can recognize all the distinguishing features of speech under good listening conditions and without the aid of speechreading or some other visual form of receptive communication. His linguistic code characteristically is more developed than that of the hard of hearing and especially of that of the deaf child."

O'Neill (1964) employs three conceptual headings in distinguishing between the terms deaf and hard of hearing.

1. Developmental Hearing Loss--deals with the age at which the hearing loss occurred. A child who has sustained a total or nearly total loss of hearing early in infancy, before speech and language patterns have been acquired, would be considered deaf. The child who has incurred such a hearing loss after speech patterns have been established would be considered hard of hearing. We would probably not have any serious retardation in his speech and language development, and he would be able to develop normal communicative habits.

2. Hearing Loss and Rehabilitation--The person with impaired hearing that can be brought up to an adequate, functional level through the use of a hearing aid or surgery cannot be considered deaf. Also, if the same or somewhat similar

results can be obtained through aural rehabilitation, we cannot consider the person deaf. The child who is deaf or who has a severe hearing loss and could not benefit from such procedures; he cannot use the auditory channel as a fully operational informational input system, so he must use other channels. He has no auditory monitoring system. Therefore, he must learn speech kinesthetically. Also, he will have to watch the lips or the gestures of the speaker in order to receive speech.

3. Severity of Hearing Loss--involves the quantitative evaluation of hearing loss. There are several numerical or percentage systems for evaluating the severity of a hearing loss. In the most common of these systems the average loss of hearing for pure tones within the so-called speech range (500 to 2000 cps) is used to indicate the severity of the hearing loss for each ear. An average loss of hearing from 20 to 40 dB through this range would be viewed as a mild hearing loss, while an average of 40 to 60 dB would be considered moderate. Losses greater than 60 dB would be considered severe hearing losses, while losses greater than 80 dB would place the individual in the category of deaf.

Lloyd's (1968) operational or functional definition is as follows:

> "Hearing impairment" refers to a deviation in hearing sufficient to impair normal aural-oral communication. The degree of hearing impairment is the result of degree of deviation in hearing (sensitivity and/or other auditory abilities) interacting with a number of other factors, e.g., age of onset, age of detection and intervention, duration, type of pathology and related factors, use of amplification, habilitating programming, family factors and resilience or compensatory (or adaptive) abilities.

Lloyd reserves use of the term "deafness" for the extreme end of the continuum where the normal acquisition of oral language is precluded.

Cutler (1974) developed the following terminology:

1. "Totally deaf, unable to speak: an individual with no residual hearing; inability to talk; educated in a residential school for the deaf; means of

communication are through manual alphabet and sign language or pencil and paper.

2. "Totally deaf, with deaf speech, but refuses to speak: an individual with no residual hearing; can speak (quality poor); educated in a residential school for the deaf; means of communication are through manual alphabet and sign language or pencil and paper.

3. Totally deaf, oralist: an individual with no residual hearing but wears hearing aid, in many cases to keep him aware of sounds in his environment; has excellent deaf speech, educated in an oral oriented residential school or day classes for the deaf; means of communication strictly through reading lips. Many of these individuals resent being handed a pencil and pad or being asked to read a written message.

4. Deafened: an individual who has had normal hearing and speech but is now totally deaf. He or she has been educated in regular schools for normal hearing. Their means of communication now are by reading the lips of whoever is speaking to them or by pencil or pad. Their speech gradually deteriorates over a period of time but is quite understandable.

5. Hard of hearing: an individual who has a partial loss of hearing function, may be aided by medical or surgical treatment or amplification electronically or vocally. He has been educated in regular schools for normal hearing. His means of communication is by having speech sounds amplified and his speech is affected by the degree of loss of hearing.

6. Hard of hearing signer: an individual who has a partial loss of hearing, usually refuses amplification. He or she failed in regular public school and thus was educated in a residential school for the deaf where he learned to communicate through use of manual alphabet and sign language. Sometimes he is referred to as being communicatively lazy. He can hear with amplification and he can speak, but prefers to use the language of signs and finger spelling and associates with the deaf rather than his hearing peers."

The following is a list of definitions of deafness by various disciplines as presented by the Conference on the Collection Of Statistics on Severe Hearing Impairments and Deafness in the United States, 1964.

1. Common Parlance--"Congenital or acquired lack, loss, or impairment of the sense of hearing whether due to defects in: 1) the sound-transmitting mechanism, 2) the organ of Corti or auditory nerve, or 3) the interpretative centers of the brain - called also respectively, 1) transmission deafness, conduction deafness or conductive deafness, 2) perceptive deafness or nerve deafness, and 3) central deafness, cortical deafness, or psychic deafness." (Webster's Third New International Dictionary of the English Language, Unabridged, 1964, p. 581).

2. Demography--A. "Deaf-mute--Include as a deaf-mute 1) any child under eight years of age who is totally deaf, and 2) any older person who has been totally deaf from childhood or was born deaf. Do not include a person who became deaf after the age of eight from accident, or from disease, or from old age. A person is to be considered as totally deaf who cannot understand loudly shouted conversation or can understand it only with the aid of an ear trumpet or other mechanical device. In case of infants or young children not old enough to understand conversation, the test should be whether they apparently hear when addressed in a loud tone of voice." (U.S. Bureau of the Census, 1931, p. 2).

B. "Specific rules employed by enumerators--Definitions and accessory procedures in exact detail governing the enumeration of deafness were as follows: a) The enumerator asked whether any member of the household is deaf. If the answer was "No," he passed on to the net schedule item; if the answer was "Yes," he was required to specify degree for each person, as determined from information elicited by asking further questions. b) In characterizing

degree, the following definitions were applied: i. partial deafness, stage one is defined as that preventing a person from understanding speech at the theater, in church, or at a conference of five or six people; ii. partial deafness, stage two is defined as that preventing a person from understanding someone speaking to him from a distance 2 or 3 feet directly in front of him; iii. partial deafness, stage three is defined as that preventing a person from understanding speech over the telephone; iv. total deafness is defined as that preventing a person from understanding speech under any conditions; v. deaf-mute is a person who was born deaf or acquired severe deafness at such an early age that he did not learn to speak. c) Enumerators were instructed not to ask whether any member of the household is "partially" deaf; this information was to be recorded only if given voluntarily. d) Degree of deafness was ascertained independently of any consideration of benefits derived from mechanical (or electrical) hearing aids or from lipreading.

Since enumerators were cautioned not to encourage informants in the reporting of deafness cases, it is expected that for the survey as a whole an underenumeration of moderate degrees of deafness was obtained. Exclusion of beneficial aids in determining degrees should result in the reporting of deafness cases strictly on the basis of the degree of social handicap involved." (National Health Survey, 1935-36, 1938, p. 12-13).

C. "Accordingly, a person is to be looked upon as such in whom the sense of hearing is wholly or practically wholly absent or nonexistent, or who is in possession of hearing too slight to be of material service, or to be of avail for the understanding of spoken language; or in whom there exists little or no sound perception (even with mechanical devices or other artificial recourse), or who is not responsive to sounds addressed to the ear; or who does not recognize the sound of the human voice or other sounds loud in volume issuing nearby; or who has not sufficient aural power for the ordinary affairs

of life--and who at the same time, and largely in consequence of the aforesaid conditions is without the faculty of speech, or is more or less deficient in speech--such speech as exists departing in greater or less recognized measure from the normal or usual speech of human society or from that in use by persons having the faculty of hearing, or from that employed as an effective means of communication, and so far as it exists, such speech having in general to be acquired or having had to be retained in form in which it now appears, only by special instruction and training--with the result that this speech is a more or less artificial one." (H. Best, 1943, p. 125).

3. Demography--A. "From the audiological point of view, a person who has a hearing loss approaching 75 decibels across the speech range is likely to need special techniques for the development of expressive communication, and we can perhaps specify what those techniques should be. The audiologist also tries to assess the deaf person's ability to receive communication. From the standpoint of the staff of the Hearing and Speech Center the deaf person, audiologically speaking, is one who does not use hearing in a reliable way with the best of amplification; one who understands very little, if anything, through hearing alone; one who is basically visually oriented." (D.R. Frisina, 1962, p. 469).

B. "We propose to confine the term 'deafness' to hearing levels for speech of 82 dB or worse. A good reason for selecting this particular boundary is that the most authoritative rule for estimating the handicap imposed by hearing loss reads 'the handicap (for hearing of everyday speech) is considered total at 82 dB hearing loss for speech'. Our criterion thus has medical sanction in a social and economic context." (H. Davis & S. R. Silverman, 1960, p. 81).

4. Education--A. "The deaf are those who were born either totally deaf or sufficiently deaf to prevent the establishment of speech and natural language; those who became deaf in childhood before speech and language were established; or those who became deaf in childhood so soon after the natural establishment of speech that understanding of speech and language has been practically lost to them."

"The hard of hearing are those who have established speech and ability to understand speech and language, and subsequently developed impairment of hearing. These children are sound conscious and have a normal, or almost normal, attitude toward the world of sound in which they live." (White House Conference on Child Health and Protection, 1931, p. 277).

B. "The deaf: those in whom the sense of hearing is nonfunctional for the ordinary purposes of life. This general group is made up of two distinct classes based entirely on the time of the loss of hearing: a) the congenitally deaf--those who were born deaf; b) the adventitiously deaf--those who were born with normal hearing but in whom the sense of hearing is nonfunctional through later illness or accident."

"The hard of hearing: those in whom the sense of hearing, although defective, is functional with or without a hearing aid." (Conference of Executives of American Schools for the Deaf, 1938, p. 1-3).

C. "The deaf are those in whom the sense of hearing, either with or without a hearing aid, is insufficient for interpreting speech. The prelanguage deaf are those in whom deafness preceded a firm establishment of language and speech. The postlanguage deaf are those in whom deafness occurred after good language and speech had been acquired."

"The hard of hearing are those in whom the loss of hearing is educationally significant, but whose residual hearing is sufficient for interpreting speech with--if not without--a hearing aid."

"A natural-language group is one composed of the hard of hearing and those post-language deaf who have retained their normally acquired speech and language." (H.Z. Wooden, 1963, p. 344).

5. Medicine--A. "Ideally, hearing impairment should be evaluated in terms of ability to hear everyday speech under everyday conditions..." (Guide for the Evaluation of Hearing Impairment, 1959, p. 236-238).

B. "At the other extreme of the hearing range, there may be a total loss of hearing or a total inability to hear speech. As commonly used, these terms are not precise nor necessarily synonymous. It is important to define them and to determine the relation between them. This cannot be done until more experimental data are available." (Council on Physical Medicine and Rehabilitation, 1955, p. 1408-1409).

C. Deafness: "Lack or loss, complete or partial, of the sense of hearing." (Dorland's Illustrated Medical Dictionary, 1957, p. 354).

6. Military Services--"Cases of true deafness involving a hearing level of the outer ear if 60 dB or more in the speech range." (U.S. Army AR 40-530-55, 1960, p. 245).

A. "As to the diagnostic criteria to be used in classifying the literate deaf in our main sample, deafness was defined as a stress-producing hearing loss, from birth or early childhood, rendering a person incapable of effecting meaningful and substantial auditory contact with the environment." (J.D. rainer, K.Z. Althshuler, F.J. Kallmann, & W.E. Deming, 1963, p. xiv).

B. "This is the situation that characterizes the smallest but most unusual section of the hearing-impaired population, numbering less than one quarter of a million persons throughout the country. Commonly known as 'deaf-mutes' or the 'deaf and dumb', its members are technically termed 'the deaf'. They are not mute, for there is no vocal impairment. Neither are they dumb, for many are

taught to speak through special instructional techniques. The great handicap of the deaf lies in the fact that permanently impaired hearing occurs during the most vulnerable time of life--from birth through early childhood--and is so severe that it deadens the most powerful developmental stimulus of all--the sound of the human voice." (p. 28).

"In the preceding chapter, discussion was centered upon the smallest category of acoustically disabled persons--the deaf. The present section deals with the largest, made up of several million individuals who are technically termed 'the hard of hearing'. Two major subgroups of this vast body will be considered here as further illustration of the multiple implications of hearing loss. They are a) the progressively deafened and b) the suddenly deafened in adulthood."

"Whereas the problems of the deaf illustrate the results of severe auditory dysfunction since birth or early childhood, those of the progressively deafened demonstrate the results of slow, gradual loss of hearing that may begin at any time of life." (E.S. Levine, 1960, p. 56).

C. "In the psychology of deafness it is generally assumed that the hearing loss has resulted from peripheral nervous system involvement, in which case a reciprocal relationship exists between the type and the cause of the deafness. If the type, sensory-neural or conductive, can be established, an inference can be made concerning the cause. Likewise, if the cause can be determined, an inference can be made concerning the type. Moreover, postulations as to the type of deafness can be made when it has been determined that the condition is exogenous, congenital or acquired, and when it is known that the person is deaf or hard of hearing. Establishing the etiology also has implications for the psychological effects which might follow..." (p. 29).

"All degrees of hearing loss are founded in the sensory-neural group. However, in general those with conductive deafness classify as hard of hearing while those with sensory-neural loss include many with profound or total deafness." (p. 40).

"Deafness occurs because of three major types of disorders. The one which is most frequent, and to which the data in the following sections pertain, is that which results from peripheral nervous system defects, from end-organ deficiencies. The other types are central and psychogenic deafness." (H.R. Myklebust, 1960, p. 41).

II. Societal Characteristics of Hearing - Impaired Persons

Impairment of hearing is the single most prevalent chronic physical disability in the United States. More persons suffer a hearing defect than have visual impairments, heart disease, or other chronic disabilities. Yet despite the frequency with which it occurs in the general population, hearing impairment receives far less attention than would be justified by the number of persons afflicted. Even basic data on the incidence and prevalence of various degrees of hearing impairment have not been gathered as often and as carefully as information on far less common health problems.

The last nationwide study of deafness--the extreme end of the impairment continuum--was conducted by the U.S. Bureau of the Census in 1930. Since that date, studies of deafness have been confined to a few states or have provided little more knowledge about the deaf population than its approximate size.

The National Census of the Deaf Population (NCDP) came into being because the forty-year gap in data made planning for social, educational, and rehabilitation services tenuous. The NCDP sought to determine the size, distribution and principal demographic, educational and vocational characteristics of the deaf population, in order to contribute current data which would improve programming and provide a baseline for the evaluation of present and future programs.

While hearing impairments of all degrees and types deserve attention, the NCDP focused on the extreme end of the impairment continuum. The population of interest consisted of those persons "who could not hear and understand speech and who had lost (or NEVER had) that ability prior to 19 years of age." The definition of the target population takes into account the degree of impairment and the age at onset. Both factors are critical to explicating the effects of hearing impairment. Damage to hearing of the same extent occurring at different stages of ontology will have different psychological consequences. The NCDP

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* Material in this section, from p. 19 to p. 25 is taken from Schein & Delk (1974). This is a major study of prevalence and demographics.

concentrates on those persons whose loss occurred before adulthood.

Design of the NCDP--Determining the Size of the Deaf Population. To determine the number of prevocationally deaf people, the NCDP followed a model used to determine the size of rare groups in large populations. First a national list of deaf persons was compiled. Then the persons on the list were contacted in order to establish that they met the NCDP criteria for prevocational deafness, were alive and residing at the given address. Next, a probability sample of 42,000 households in the United States was drawn and interviews conducted to locate all prevocationally deaf persons in the households. By comparing the prevocationally deaf persons in the households to those on the verified list, the completeness of the list could be estimated; i.e., the household survey provided an approximation to the size of the unlisted group. Adding the number probably not on the list to the actual number on the verified list yielded the total number of prevocationally deaf persons.

Determining the Characteristics of Prevocationally Deaf Persons. To gather detailed information about deaf persons, a national sample was drawn from the verified list. Specially trained interviewers were sent to question the listed persons and members of their households. Their responses were then weighted to reflect the verified deaf population. The results provide the bulk of the material on education, vocation and related matters in the following material.

The design of the NCDP called for combining the results of list building with those from a stratified random sample of the civilian, non-institutionalized population. The verified list yielded a total of 98,448 prevocationally deaf persons. To this total was added the unduplicated estimate of prevocationally deaf persons from the Health Interview Survey (HIS) of the National Health Survey--312,074. The total of 410,522 when divided by the civilian noninstitutionalized population yields a prevalence rate for prevocational deafness of

203 per 100,000. The corresponding rates for hearing impairment and deafness at all ages are shown in Table 4, which places the estimates in a context displaying the relations between degrees and ages at onset of impairment.

The figure for total hearing impairments--about 6.6 percent--includes all persons who responded in an interview that they "had trouble hearing in one or both ears". Of this group, half reported difficulties in both ears. A little more than 13 percent of the hearing impaired group (0.87 percent of the population) indicated that they could not hear and understand speech; i.e., they are deaf.

When the deaf group is subdivided by age at onset, a little less than one fourth fall into the prevocational category (hearing ability lost before 19 years of age) and 11.4 percent in the prelingual category (hearing ability lost before 3 years of age).

Size--the NCDP estimates prevocational deafness at 2 per 1,000--twice the formerly accepted rate--or, more precisely, 203 per 100,000 population.

A discrepancy between expectation and result of this magnitude naturally raises questions about its accuracy. Statistically, the standard error for the estimate is 6.3 percent. This means that the "true" rate will fall between 190 and 216 per 100,000 in 2 of 3 instances affected by sampling errors only. 95 of 100 times the true rate will be between 177 and 220 per 100,000. If non-random errors intrude, then these calculations do not hold. The examiner's own appraisal is that the rate of 203 per 100,000 may be too low because of the lower rates for nonwhite persons. The statistical model used by NCDP, however, has been well accepted and should produce a reasonable approximation of the actual figure.

Of course, the number of deaf persons has grown since 1930, simply because the United States has a greater population: 123,203,000 in 1930, and

TABLE 2-4

PERCENT OF DISTRIBUTION OF AGE AT ONSET OF DEAFNESS, BY SEX AND RACE OF RESPONDENTS: UNITED STATES, 1972

Sex and Race	Total	Born Deaf	Less Than One	1-2	3-5	6-11	12-18
All Groups	100.0	41.4	12.6	19.6	14.9	7.9	3.6
Male	100.0	41.3	14.2	19.1	13.4	8.4	3.6
White	100.0	42.4	13.9	19.4	13.5	7.3	3.5
Nonwhite	100.0	31.4	17.6	16.7	12.7	17.3	4.2
Female	100.0	41.6	10.8	20.0	16.5	7.4	3.6
White	100.0	42.1	11.1	20.9	14.9	7.5	3.6
Nonwhite	100.0	38.0	8.1	13.1	29.6	7.1	4.0

Source: Schein & Delk, 1974, p. 114.

203,212,000 in 1970. The rate for deafness is another matter. The Bureau of the Census counted 47 deaf persons per 100,000 in 1930; we now estimate 203 per 100,000. Why the increase? Is deafness occurring more frequently? Or have the earlier enumerations been so inaccurate? Or is some of the discrepancy due to different definitions?

The answers to each of the three questions would appear to be yes. Though we can only speculate as to the amount, there seems to be little doubt that there are proportionally, as well as actually, more deaf people today than 40 years ago. The lack of specificity as to the extent of growth arises from the nature of prevalence rates. Differences between two prevalence rates can be attributed to changes in the denominators as well as the numerators. Incidence data, not available in the United States, are reflected to elucidate the observed trends. Nevertheless, the sheer size of the contrast between the 1930 and 1971 estimates of deafness argue for a true increase in deafness.

With respect to under enumeration, it must be noted that the Bureau of the Census itself declared its procedures in 1930 to be inadequate. From 1830 to 1930 the Bureau's 11 decennial enumerations of the deaf population produced rates varying from 32 to 67 per 100,000. The range of those figures alone casts doubt on the techniques being used.

The biggest problem seemed to be the definition used. Each census taken made the determination of deafness. In the NDCP, deafness was defined by responses to a series of questions and not by the interviewers judgment. The Bureau considered a person to be deaf if he lost the ability to hear before 8 years of age. The NDCP used another upper age at onset, 18 years. When adjusted to the same age at onset as used in the 1930 census, the NCDP's rate is 160 per 100,000. The new rate is more than three times larger than the 1930 rate. That it reflects an actual growth in the relative prevalence of deafness, therefore, remains highly likely.

Relation of Degrees of Hearing Impairment--When attention to the full range of hearing impairment replaces a focus solely on the severest degree, then the frequency of deafness in the population becomes more credible. The NDCP estimates that 13.4 million persons have an impairment of hearing. Of these, 1.8 million are deaf, and about 0.4 million became deaf before 19 years of age. Seen in these terms, the size of the prevocationally deaf population does not appear overly gross, occurring in about 3 percent of all hearing impaired persons.

Age at Onset-- Definitions of deafness have tended to take the age at which the loss occurred into account. The reason probably involves the fact that the earlier hearing is lost the more severe are the consequences to speech and language development. Persons who become deaf after developing speech usually retain it, while prelingually deaf children have great difficulty in acquiring speech. Language development is also more seriously disrupted by early childhood deafness than by deafness occurring in teenage.

These relationships translate directly into economic consequences. Personal earnings are lowest for those born deaf and highest for those deafened after 11 years of age, with proportional gradations between these two categories. Prelingually deaf persons do less well in the job market, holding fewer professional and technical positions than postlingually deaf persons. An interesting feature of the NCDP data deviates from this general finding and deserves being followed up: born-deaf workers held proportionally more high-grade jobs than those who lost their hearing after birth but before age 3.

The consequences of early as opposed to later deafness are not independent of education. Educational preparation obviously differs for the two groups. The majority of prelingually deaf adults spent some of their academic tenure in residential schools. The majority of those whose deafness occurred betwen

12 and 18 years attended no schools for hearing impaired students. Since the amount, and probably the quality, of schooling bear a strong relationship to occupational status and personal income, the relationships between these outcomes and age at onset are likely to be some joint function of it and education. The kind of education received depends, in part, on the age at onset of deafness. In turn, the economic factors associated with age at onset also depend upon education.

Demographically, the skewed distribution of ages at onset in the NCDP data arouse interest. The incidence of deafness may be inferred to be U-shaped. Deafness occurs most frequently in infancy and old age. Acquisition of deafness appears to decline rapidly from birth through five years of age, and to remain fairly constant until the fifth decade when it begins to increase markedly. Systematic incidence data would also provide important epidemiological information now lacking in the United States.

The following material, from p.26 to p.39 is taken from Schein & Delk (1974).

Relation to Earlier Prevalence Rates--How do these rates compare to others calculated at different points in time and gathered by various method? In order to answer that question, care must be given to the definitions underlying the terms used and to the means by which data were gathered. The studies reviewed below are presented so as to aid in the assessment of the NCDP's findings.

The United States Census--From 1830, the United States Bureau of the Census included an enumeration of deaf persons in each decennial census. The prevalence rates from 11 decennials are shown in Table 2-5, which reveals the extreme fluctuation from a low of 32.1 per 100,000, in 1900, to a high of 67.5, in 1880 - the larger rate being more than twice the smaller rate. The erratic nature of these data caused the Bureau to conclude, "No high degree of accuracy is to be expected in a census of the blind and of deaf-mutes carried out by the methods which it has been necessary to use thus far in the United States" (U.S. Bureau of the Census, 1932). The Bureau gave up the enumeration of deafness and other disabilities after 1930, recommending to the government that a separate agency be established for that purpose. It is apparent that the last Census prevalence rate, 47 per 100,000, is far less than the rates from NCDP, including that for prelingual deafness. The Bureau's 1930 instructions limited deafness to those whose hearing loss occurred prior to 8 years of age. Using that same age at onset, the NCDP presently estimates deafness at 160 per 100,000 or 3.4 times as great a rate as reported in 1930. (p. 17).

The National Health Survey--In 1956, the Congress appropriated funds for the National Health Survey (NHS), a division of the National Center for Vital and Health Statistics. NHS is charged with "determining the health of the

TABLE 2-5

PREVALENCE AND PREVALENCE RATES PER 100,000 POPULATION FOR PRELINGUAL DEAFNESS: UNITED STATES, 1830-1930

Year	Number	Rate Per 100,000
1930	57,084	46.5
1920	44,885	42.5
1910	44,708	48.6
1900	24,369	32.1
1890	40,592	64.8
1880	33,878	67.5
1870	16,205	42.0
1860	12,821	40.8
1850	9,803	42.3
1840	7,678	45.0
1830	6,106	47.5

Source: U.S. Bureau of the Census, reported in Schein & Delk, (1974), p. 18.

nation" (National Center for Health Statistics, 1965). Each year NHS interviews a stratified random sample of the United States population to inquire about various conditions affecting the physical well-being of the household members. Questions about hearing ability are routinely included in the annual Health Interview Survey (HIS). In 1962 and agin in 1971, a more extensive series of questions about hearing were included. These data will be referred to as HIS '62 and HIS '71 respectively.

NHS also conducts physical examinations of samples of the population. In 1960-62 a sample of adults aged 18 to 79 years was given audiometric tests (Glorig and Roberts, 1965). Hearing ability of a sample of children 6 to 11 years of age was tested in 1963-65 (Roberts and Huber, 1970). Results from these audiometric examinations will be referred to as HES '60 and HES '63 respectively.

HIS '62--For HIS '62, degree of impairment was determined by a series of statements which will be referred to as Hearing Scale I.
The items making up Hearing Scale I form a hierarchy of hearing impairment such that once a person responds No to a statement he will respond No to all those succeeding it.

Persons reported in the household interviews to have a hearing problem were mailed a questionnaire which included Hearing Scale I. (p. 18).

The estimates of hearing impairments are based on the responses to the mail questionnaire plus information gathered in the household interview. The survey design is explained fully in Gentile, Schein, and Haase (1967). Briefly, it involved a stratified random sample of the civilian, noninstitutionalized population of the United States, consisting of about 134,000 persons in 42,000 households which were visited between July 1962 and June 1963.

TABLE 2-6

PREVALENCE AND PREVALENCE RATES FOR PERSONS IDENTIFIED AS HAVING TROUBLE IN HEARING IN THE HEALTH INTERVIEW SURVEY OF 1962-63 (HIS '62) BY DEGREE OF IMPAIRMENT: UNITED STATES, 1962-63.

Degree of Hearing Impairment	All ages at onset	
	Number	Rates Per 100,00
All persons[a]	8,005,000	4,370
Reported hearing good	647,000	350
Unilateral impairment only	2,470,000	1,350
Bilateral impairment	4,085,000	2,230[b]
Unable to understand speech	855,000	470
Able to hear and understand a few words	736,000	400
Able to hear and understand most speech	2,439,000	1,330
Nonresponse	804,000	440

[a]Does not include persons under 3 years of age.
[b]Includes 54,000 persons for whom degree of loss is unknown.

Source: Gentile, Schein, and Haase, 1967, reported in Schein & Delk, 1974, p. 19.

Table 6 shows the estimates of hearing impairment from that survey. The category "unable to understand speech" includes those persons answering No to the fourth statement in Hearing Scale I ("I can hear and understand a little of what a person says without seeing his face and lips"), as well as those responding No to the previous statements. When age at onset is taken into account the categories are divided into those with onsets prior to 17 and those at or after 17 years of age (Table 2-7)

If only those in the category "unable to hear and understand speech" are considered deaf, then the HIS '62 prevalence rate for prevocational deafness is 126 per 100,000 compared to NCDP's 203 per 100,000. Some increase in the HIS '62 rate should be made for the two-year differential in age at onset; but the adjustment would be small. Much larger adjustments are in order for the "unknowns" - 54,000 for whom degree of impairment was not determined and 443,000 missing age at onset. Some number of these latter persons would be expected to fall into the prevocationally deaf category. Furthermore, Hearing Scales I and II are not precisely coordinated; hence some portion of the group classified as "able to hear and understand a few words" on Hearing Scale I might have fallen into the deaf category on Hearing Scale II. The combined rate for the two most severe categories of Hearing Scale I is 212 per 100,000 without adjustments for unknowns and lower age onset. This latter figure is well within one standard error of the NCDP rate for prevocational deafness.

HES '60--The Health Examination Survey (HES) provides an audiometric assessment of hearing in adults. The proportion of the population with severe handicaps - thresholds of 45 dB or more, including those who have difficulty in understanding loud speech, those who understand only amplified speech, those who cannot even understand amplified speech - is about 1% for

TABLE 2-7

PREVALENCE AND PREVALENCE RATES FOR PERSONS CLASSIFIED AS HAVING A SIGNIFICANT BILATERAL IMPAIRMENT OF HEARING, BY DEGREE AND AGE AT ONSET: UNITED STATES, 1962-63.

Degree of Impairment/ Age at Onset	Number	Rate Per 100,000
All Ages at Onset		
Significant Bilateral Impairment	4,085,000	2,230[a]
Unable to understand speech	856,000	467
Able to hear and understand a few words	736,000	402
Able to hear and understand most speech	2,439,000	1,331
Onset before 17 years of age		
Significant Bilateral Impairment	843,000	460
Unable to understand speech	231,000	126
Able to hear and understand a few words	157,000	86
Able to hear and understand most speech	450,000	246
Onset at or after 17 years of age		
Significant Bilateral Impairment	2,799,000	1,528
Unable to understand speech	561,000	306
Able to hear and understand a few words	536,000	293
Able to hear and understand most speech	1,682,000	918
Age at Onset Unknown		
Significant Bilateral Impairment	443,000	242
Unable to understand speech	64,000	35
Able to hear and understand a few words	43,000	23
Able to hear and understand most speech	307,000	167

[a]Does not include persons under 3 years of age.
[b]Includes 54,000 persons for whom degree of loss is unknown.

Source: Gentile, Schein and Haase, 1967, reported in Schein & Delk, 1974, p. 20.

all persons between 18 and 79 years of age. An estimated 1.2 million persons in the adult population have such a handicap.

As shown in Table 2-8, the HIS '65 data probably underestimates significant bilateral hearing impairment when compared to HES '60. If a hearing level for speech of 25 dB is accepted as the point beyond which a hearing impairment is considered significant (e.g., Glorig and Roberts, 1965), then the prevalence rate is 7,309 per 100,000 compared to the HIS '62 estimate of approximately 4,000. The 1971 Health Interview Survey's estimate of significant bilateral hearing impairment is even less - 3,236 per 100,000. The discrepancy may be accounted for by the relatively low audiometric threshold considered significant; persons with better-ear-average hearing levels between 26 and 39 dB usually have difficulty only with faint speech. An interview may fail in many instances to identify the problem because it causes too little discomfort to the individual or because it is not readily apparent to a proxy respondent.

Persons with hearing levels at 76 dB have a sensorineural component which means that the speech signal they receive will be distorted. Usually they can hear and understand only shouted or greatly amplified speech, if at all. Beyond 90 dB little speech comprehension occurs, even with best available amplification. If persons with hearing levels greater than 75 dB are considered deaf, then the audiometric survey yields a prevalence rate less than half that found in the NCDP; i.e., 414 versus 873 per 100,000.

Apparently, more than sampling error is needed to explain the difference in obtained rates. The results suggest that most individuals find a hearing level of 26 dB less disruptive of communication and 76 dB more disruptive than has generally been assumed. Thus, in an interview, a person with a small, but medically significant, hearing loss would tend not to report it; while at the other end, a person with a loss medically considered

TABLE 2-8

PREVALENCE RATES PER 100,00 FOR BETTER-EAR-AVERAGE HEARING LEVELS OF ADULTS (18 TO 79 YEARS OF AGE) BY AGE, SEX, AND RACE: UNITED STATES, 1960-63.

Sex/Age/Race	Rate per 100,000 by Better-Ear Average Hearing Levels[a]	
	26 dB and Over	76 dB and Over
Both Sexes	7,309	414
18 to 44 Years	1,770	136
45 to 64	6,942	240
65 and over	32,269	2,073
Males	7,686	443
Females	6,969	389
White	7,400	[b]
Black	6,600	[b]

[a]Decibel level is converted to ISO.
[b]Not available.

Source: Glorig and Roberts, 1965; Roberts and Bayliss, 1967, reported in Schein & Delk, 1974, p. 21.

only to be severe would describe it as profound. The development of Hearing Scale II (Schein, Gentile and Haase, 1970) corroborates this reasoning. Persons denying the ability to hear and understa[illegible] speech had average hearing levels of 81.8 dB. This latter group includes persons who even stated they could not hear loud noises. The Health Examination Survey of 1974 (Miller, 1973) should provide additional evidence on the functional significance of the hearing levels.

An earlier attempt to reconcile the prevalence rates from HIS '62 and HES '60 led to the comparison shown in Table 2-10. By making the adjustments at the mild and severe ends of the continuum, nearly identical rates are produced. That these independent studies yield such close estimates mutually supports their methodological adequacy.

Surveys of Children--Two national audiometric studies have been made of samples of children. The Health Examination Survey in 1963-65 (HES '63) tested 7,119 children representing the noninstitutionalized population aged 6 to 11 years (Roberts and Federico, 1972). In 1968-69, the National Speech and Hearing Survey tested 38,568 students in a national sample of grades 1 to 12. Because of the small numbers involved, results from both studies show only those having a significant bilateral hearing impairment; i.e., a hearing level for speech greater than 25 dB (see Table 2-11). The rates are reasonably close, the difference being accounted for by differences in age ranges and sampling error. What is also noteworthy are the relatively large numbers of children having a significant hearing loss. Both samples exclude children in residential settings. The National Survey excludes children in all special schools, day or residential. With these thoughts in mind, educators must view with great concern

TABLE 2-9

ESTIMATED DISTRIBUTION OF HEARING IMPAIRMENT FOR SPEECH AMONG THE ADULT POPULATION AS DETERMINED BY AUDIOMETRY (HES '60) AND SELF-ESTIMATE (HIS '62): UNITED STATES, 1960-63.

Speech Comprehension Group[a]	Rates per 100,000 HES '60	HIS '62
Some difficulty (40 dB+)	2,700	2,700
Can hear and understand most spoken words (40 to 54 dB)	1,600	1,700
Can hear and understand a few spoken words or cannot hear and understand any (55 dB+)	1,100	1,000

[a]The verbal descriptions are from HIS '62. The numerical values are hearing levels for speech in the better ear converted to ISO (original in ASA).

Sources: HES '60 from Glorig and Roberts (1965); HIS '62 from Gentile et al. (1968). Reported in Schein and Delk, 1974, p. 23.

TABLE 2-10

PREVALENCE RATES FOR UNITED STATES SCHOOL CHILDREN[a] WITH BETTER-EAR-AVERAGE HEARING LEVELS GREATER THAN 25 DECIBELS (ISO), FROM TWO AUDIOMETRIC SURVEYS.

Source of Rate	Rate per 100,000
Health Examination Survey, 1963-65[a]	887
National Speech and Hearing Survey, 1968-69[b]	730

[a]Excludes children in residential schools and other institutions for handicapped children.

[b]INcludes children in grades 1-12.

Reported in Schein and Delk, 1974, p. 24.

the serious extent of hearing problems among today's children, since special programs for such children accommodate less than half of them.

One of the best estimates of the prevalence of hearing loss among public school children was derived from a study of Pittsburgh school children (Eagles, et al., 1963). They found that 1.7% of children 5-10 years of age had losses greater than 26 dB.

Weber, McGovern and Zink (1967) analyzed the records of 1,000 school children who had been screened during a five year period. All children who failed at 20 dB (ISO) in the speech range were referred for additional study. After further testing, the prevalence of hearing loss remained at approximately 3% using a definition of 40 dB (ASA) or greater in either ear, the National Society for the Study of Education (1950) found that, on the average, 5% of the general school population possessed a hearing loss.

Lipscomb (1973) reports on hearing examinations of 7,119 school children considered to be representative of the 6-11 age group. He found that about 20% had at least one change or abnormality in an ear or in hearing acuity. About 14% had occluded auditory canals which prevented an examination. Some 9.7% had abnormal tympanic membranes on both sides. Some 4.2% of the parents reported that their child had a problem in hearing.

Although it is clearly difficult to arrive at generalizations given the diversity of Samples studied and criteria used, it appears that approximately .2% of the school age population are severely and bilaterally impaired or deaf. Approximately 3 to 5% of school children manifest some degree of hearing loss, and some types of hearing impairment increase as a function of age (Bensberg & Sigelman, 1975).

Institutionalization--The NCDP's target population was the civilian non-institutionalized population. Residents of mental hospitals, prisons, institutions for mentally retarded persons, etc., were not included. Since there is some evidence indicative of a disproportionate number of prevocationally deaf persons in institutions (e.g., Webb et al., 1966), the likelihood is that the prevalence rate for deafness in the institutionalized population would exceed that for the noninstitutionalized population.

Surveys of institutionalized groups may prove particularly valuable, because of the suspicion that some inmates suffer from nothing but deafness. Deaf persons have been unjustly imprisoned, mistakenly diagnosed as psychotic, and incorrectly labelled mentally retarded. A study which aimed at determining the prevalence of hearing impairment in an institution might uncover some of these improperly incarcerated individuals, through serendipity if not design. In any event, the reader should bear in mind that the NCDP did not include institutionalized deaf persons (Schein & Delk, 1974, p. 33).

Changes in Prevalence and Future Trends--One of the unfortunate consequences of the earlier lack of attention to statistics on deafness is the present inability to determine with any high degree of certainty the trend in prevalence. The 100 years of census data (Table 2-6) yielded an eccentric senses of rates. The eleven figures do not fall along any uniform trendline. It seems likely that a sizeable portion of the differences between decennial rates can be attributed to methodological factors - definitions, interviewer's bias, etc. - rather than to true differences in the population.

How, then, do we respond to the important question, Has the prevalence of deafness in the United States increased or decreased? This question closely relates to the predictive query, Is deafness becoming more or less prevalent?

The NCDP prevalence rate for deafness acquired at or before age 8 exceeds the 1930 Census figure by more than 3 times: 160 to 48 per 100,000. We use

the earlier age at onset for the NCDP estimate to conform to the definition used in the 1930 decennial. Even if the Bureau of the Census counted only half the deaf population - an unlikely event - there remains a substantial increase in prevalence. It appears highly likely that early deafness has become relatively, as well as actually, more prevalent over the last 40 years.

Better medical care has probably contributed to the increase. Diseases like meningitis need no longer cause death, but the high fevers and the destructive invasions of the meninges accompanying these diseases do cause deafness as a function of inner-ear damage. Paradoxically, further improvements in health care may result in a lowering of the prevalence of deafness by preventing infections; yet some antibiotics which alleviate infections are ototoxic themselves, producing a minor countertrend of iatrogenic deafness (Schein, 1973).

The available data, however, do not permit more than gross statements regarding prevalence rates over time. The necessary information on incidence has not been gathered. Present knowledge about causes is inadequate to identify significant factors which, it could be predicted, might contribute to fluctuations in the amount of deafness (cf. Chapter VII). However, the establishment of the Annual Survey of Hearing Impaired Children and Youth (Gentile and DiFrancesca, 1969) provides a source of data which will, in time, enable elucidation of trends among the student population. Another sign comes from the laws in New Jersey and Virginia mandating reporting systems for various conditions, including childhood deafness. When combined with appropriate survey techniques, the registers in these states will become valuable tools for epidemiologists, as well as for educational and rehabilitation administrators.

Turning to hearing impairment, several factors indicate a greater prevalence within the next few years. First of all, persons are living longer which increases

prevalence rates. Secondly, noise levels have continued to grow in our cities and our population has become more urbanized, therefore increasing hearing impairment due to acoustic trauma. Again, improved medical care in the short run will probably, as in the case of deafness, result in more hearing loss by saving from death persons assaulted by various diseases and injuries.

A significant counter factor has been the surgical treatment of conductive hearing impairment. While otosurgery is still relatively young and long-term assessments of its benefits are not yet concluded, the techniques have at least had spectacular short-term effects. Successful treatment of sensorineural impairment, however, remains for the future. It would appear, then, that the available data point to increasing prevalence rates for hearing impairment and deafness, though their magnitude and pace remain obscure (Schein & Delk, 1974, p. 33-34).

III. Demographics

(Much information in this section is taken from Schein & Delk, 1974)

Age--A greater prevocational deafness rate appears in ages 6 to 24 than 25 to 44 years. The highest rate of prevocational deafness is in the 65-and-over category. The 6-to-16 year category contains prevocationally deaf persons at a rate 38 percent greater than the 25-to-44 group and 12 percent greater than the 17-to-24 group, so that even if the general population reamined constant, the proportion requiring special services would grow rapidly. Equally impressive is the fivefold increase in the prevalence rate from the 25-to-44 to the 65-and-over categories. Does this difference reflect some substantial epidemics in the period from 1900 to 1920? That would, of course swell the numerator in the prevalence ratio. Another possibility is that death rates are lower for the prevocationally deaf group, thus reducing the denominator disproportionately.

HIS '62 obtained a similar though less extreme trend. For persons with age at onset before 17 years, the following prevalence rates appeared:

Present Age	Prevalence/100,000
Under 17 years	135
17 to 44	198
45 to 64	287
65 and over	397

Sex--Deafness occurs more frequently among males than females. This finding holds true in the NCDP for all ages (Table 2-12). Overall the male excess is very small, about 2 percent, which is far less than is generally found (Fraser, 1964; Schein, 1973). The actual number of deaf females is, of course, greater than that of deaf males, because the United States now has more females than males in the general population. It is the proportion of

prevocationally deaf persons in each group which is larger for males than females.

When significant bilateral hearing impairment is considered (Table 2-12) the male excess emerges more emphatically. Again the higher prevalence rates are found for males at every age level, and the better than 1.5:1 ratio resembles more closely the findings of earlier investigations for deafness, suggesting that the smaller difference found for prevocational deafness may reflect sampling error.

HES '60 found that the prevalence of hearing handicaps is similar for men and women. The classifications of hearing handicaps employed, however, are related solely to pure-tone audiometric measurements and are not related to medical diagnosis and deliberately disregard the numerous other difficulties in understanding speech.

HIS '62 reported that the prevalence of binaural hearing loss is greater among males than females, and this held true for each of the age groups considered. The differences were, however, much greater for older age groups. The difference in rates between the sexes is primarily due to the different rate among those with the least hearing loss, i.e., the group defined as "can hear and understand most spoken words". Rates for males and females do not differ much in the most severe hearing loss groups.

TABLE 2-11

PREVALENCE AND PREVALENCE RATES FOR PREVOCATIONAL DEAFNESS IN THE CIVILIAN, NONINSTITUTIONALIZED POPULATION, BY AGE AND SEX: UNITED STATES, 1971.

Sex/Age	Number	Rate per 100,000
Both Sexes		
All Ages	410,522	203
Under 6	8,071	38
6 to 16	86,278	191
17 to 24	46,154	169
25 to 44	56,865	119
45 to 64	93,839	225
65 and over	119,315	617
Females		
All Ages	210,727	201
Under 6	3,796	36
6 to 16	40,844	184
17 to 24	23,530	163
25 to 44	28,424	116
45 to 64	47,539	218
65 and over	66,594	597
Males		
All Ages	199,795	205
Under 6	4,274	39
6 to 16	45,434	198
17 to 24	22,624	176
25 to 44	28,441	125
45 to 64	46,300	233
65 and over	52,722	644

Reported in Schein and Delk, 1974, p. 28.

TABLE 2-12

PREVALENCE AND PREVALENCE RATES FOR SIGNIFICANT, BILATERAL IMPAIRMENT BY AGE AND SEX: UNITED STATES, 1971

Sex/Age	Number	Rate per 100,000
Both Sexes	6,549,643	3,237
Under 6	56,038	262
6 to 16	334,557	852
17 to 24	235,121	862
25 to 44	642,988	1,356
45 to 64	1,870,356	4,478
65 and over	3,360,583	17,368
Females	2,706,124	2,583
Under 6	23,771	227
6 to 16	155,738	701
17 to 24	81,923	568
25 to 44	243,403	990
45 to 64	610,741	2,783
65 and over	1,590,818	14,257
Males	3,843,519	3,938
Under 6	32,267	295
6 to 16	228,819	997
17 to 24	153,198	1,191
25 to 44	399,585	1,749
45 to 64	1,259,885	6,535
65 and over	1,769,765	21,606

Reported in Schein & Delk, 1974, p. 29.

Ethnicity. Hearing impairment, deafness, and prevocational deafness have been found to preponderate among whites. While the evidence for this predilection is quite straightforward with regard to deafness and prevocational deafness, findings concerning hearing loss are less clear. Most researchers, however, share the view that these conditions occur more frequently among whites (Schein & Delk, 1974). Table 2-13 shows the prevalence rates for prevocational deafness differentiated by race and sex for the year 1971.

TABLE 2-3

PREVALENCES AND PREVALENCE RATES FOR PREVOCATIONAL DEAFNESS IN THE CIVILIAN, NONINSTITUTIONALIZED POPULATION, BY RACE AND SEX: United States, 1971.

Sex/Race	Number	Rate per 100,000
Both Sexes	410,522	202
White	372,516	210
Nonwhite	38,006	150
Female	210,727	201
White	191,699	210
Nonwhite	19,028	143
Male	199,795	205
White	180,817	211
Nonwhite	18,978	159

Source: Schein & Delk, 1974, p. 32.

Some researchers have questioned the findings of many prevalence studies on the basis of sample bias. Schein and Delk (1974) point out that the U.S. Bureau of the Census, upon which data many prevalence studies have been based, has indicated that it is likely that only 85% of all blacks are counted. This is attributable to such factors as low socioeconomic status. Other variables which may contribute to bias in prevalence studies are the relative visibility and saliency of the white and nonwhite deaf populations. Schein and Delk (1974) have observed that the white deaf community appears not only to be more organized,

but that there is also a greater tendency for white deaf individuals to affiliate themselves with organizations. Thus, studies which rely on agencies and other specialized organizations of deaf persons are highly likely to show a preponderance of whites. Nevertheless, the bulk of the evidence does point to an excess of deafness and hearing impairment among the white population (Schein & Delk, 1974).

Socioeconomic status--White deaf males are employed somewhat more frequently than white males in general, but nonwhite deaf males and both white and nonwhite deaf females have far higher unemployment rates than their general population counterparts--differences of 1.5 to 5.3 percent (Schein & Delk, 1974).

Deaf workers appear subject to considerable underemployment. Forty-three percent of those who completed some postsecondary education have jobs as clerks, laborers, operators, and service and household workers. Not every person with an educational level of attainment above the average for his occupational classification is underemployed; but the NDCP data, insofar as educational criteria alone are applied, indicate a sizeable amount of underemployment among those who are prevocationally deaf (Schein & Delk, 1974).

The average annual income for employed deaf persons fell $2,273 below the comparable figure for the general population--$5,915 versus $8,198. The prevocationally deaf worker's average income is 72 percent of the general population average. The nonwhite deaf worker earns, on the average, only 62 percent as much as nonwhite workers in general (Schein & Delk, 1974).

HIS '62 found that the prevalence of binaural hearing impairment decreased as the amount of family income and educational attainment of the individual increased. This pattern is quite similar in each of the age groups considered. (The authors caution that size of family and other variables affecting income were not considered) (Schein & Delk, 1974).

Within each of the age and sex groups, the rates for persons with binaural

hearing loss are highest for the lowest income groups and, in general, rates decreased as family income increased. 2,241,000 of the persons (approximately 55%) with binaural hearing loss have family incomes below $4000 (Schein & Delk, 1974).

Education--The average educational attainment of prevocationally deaf adults falls below that for the general population. Over one third of the deaf population 25 to 64 years of age have completed high school (12th grade), and 12 percent have gone to college for one or more years, half of whom have earned baccalaurate degrees. But more than half of the adult deaf population have not completed high school, and 28 percent have only an eighth-grade education or less (Schein & Delk, 1974, p. 51). It is important to note, moreover, that academic achievement of deaf students differs from students in general who have completed the same grade. The average deaf high school graduate has probably not achieved as much academically as his or her nondeaf counterparts. Grade equivalents based on achievement test data gathered by the annual survey of Hearing Impaired Children and Youth place the deaf students several years behind his normal-hearing peers (Gentile and DiFrancesca, 1969; DiFrancesca, 1972 in Schein & Delk, 1974).

Overall, the deaf sample is one year below the national educational level. This finding holds for males, females, white males and white females. Non-white deaf males on the other hand, exceed the grade level of general nonwhite males by 0.4 year, and nonwhite deaf females exceed general nonwhite females by 1.2 years (The authors caution that the nonwhite sample may be unrepresentative) (Schein & Delk, 1974, p. 54).

Although the median grade attained is nearly identical for males and females, the distributions differ significantly. Fifty-two percent of both sexes did not complete 12th grade, but nearly 31 percent of females did not complete

9th grade. Females completed one or more years of college at a rate of 10.7 percent compared to 13.4 percent for males (Schein & Delk, 1974).

According to HIS '62 data, among adult persons in the general population who have completed less than 9 years of school there were proportionately more persons with binaural hearing loss than among persons who had completed 9-12 years of school or among persons with one year or more of college attendance. Belton (1973) offers a liberal estimate of the proportion of deaf persons who ever attain a median achievement level of 12th grade as being one percent. The median grade equivalent in spelling and arithmetic for deaf 16-year-olds is sixth grade.

Urban Rural--According to HIS '60 adults in rural areas were found somewhat more likely to have a hearing handicap than those in all urban areas combined. Within the urban areas, a hearing handicap was more likely to be found among adults in "urban places of 25,000 or more outside of urbanized areas" and less likely in large metropolitan areas of "1 to 3 million" (Schein & Delk, 1974). Similarly, HIS '62 reported the prevalence rate to be lowest in urban areas.

Geographic Region--When the U.S. is quartered regionally, the largest prevalence rate for prevocational deafness is found in the North Central region and the lowest in the Northeast, the former having a rate almost 29 percent larger than the latter. The South and West have nearly indentical rates, about 20 percent lower than that for the North Central region (Schein & Delk, 1974, p. 23).

"These rates differ from HIS '62 in which the South had a higher rate than the West which in turn had a higher rate than the North Central. The Northeast again had the lowest prevalence rate. These relationships hold for all three degrees of hearing impairment, though the magnitude of the differences varies widely" (Schein & Delk, 1974, p. 24).

"The regional differences in rates for prevocational deafness are also found for hearing impairments, though the magnitude of the differences and their directions were at variance. The highest rate for hearing impairment occurs in the West, not in the North Central as is the case for prevocational deafness. This finding agrees with that of HIS '62. Similarly, the South has a higher rate for hearing impairment than the North Central region. The rates for the West, South and North Central regions, however, are fairly close--within a range fo 7 percent" (Schein & Delk, 1974, p. 24).

"The rates for deafness occurring at all ages have a different distribution than for hearing impairment and prevocational deafness. The North Central region has the highest rate for deafness, but the West has the second highest rate. However, for deafness the difference in the rates for the South and West is only 4 percent, and less than 1 percent for prevocational deafness. In short, the prevalence of deafness appears at a pretty uniform rate in the North Central, South, and West, and it is decidedly lowest in the Northeast, when age at onset is not taken into account" (Schein & Delk, 1974, p. 24).

IV. Etiology

Deafness is multiply determined. It is the common result of diverse causes. Thus, in terms of the hearing loss per se, the cause may be accident, injury, illness, heredity, or a combination of these factors (Schein & Delk, 1974, pp. 115-117).

There are several factors which make it difficult to obtain accurate information about the etiology of hearing loss. In many cases of congenital deafness, a specific diagnosis was not made, because the cause was unknown at that time; e.g., maternal rubella was only recently identified as a possible

TABLE 2-14

ETIOLOGY OF HEARING LOSS

Study	Population	N	Unknown	Genetic	Prenatal		Perinatal		Postnatal	
Fisch (1973)	referred children	600	25.0%	26.0%	24.0%	rubella	14.0%		--	
Ruben and Rozycki (1971)	referred children	348	20.0	60.0		20% acquired				
Fraser (1970)	referred children	2,355	36.2	30.4	5.9		5.4		19.7	
Lindsay (1973)	referred children			51.5	6.0		10.0		30.0	
Surjan, Dvald, & Palvavi (1973)	referred adult	32,397		1.5					71.8 19.5 19.0 11.0 12.0	approximate total presbyacusis noise induced tympanosclerosis chronic otitis
Wright (1973)	referred young children	302	25.9	12.3	14.4 1.6	rubella toxemia	10.2 4.8 6.4	anoxia premature kernicterus	17.5	
Budden, et al (1974)	referred preschool	500	48.4	18.2	15.2 1.2	rubella other	6.4 5.25	total kernicterus	10.6 7.8	total meningitis
Schein and Delk (1974)	adult deaf self-supporting	410,522	17.1	7.6	24.2 5.2	total rubella	2.5		42.5 9.7 6.2	total meningitis scarlet fever
Vernon (1969)	Applicants to School for Deaf	1,468		5.4 (both parents deaf)	8.8	rubella	11.9 3.1	premature Rh	40.4 8.1 7.3 25.0	total meningitis other infections other

from Bensberg, G.J., & Sigelman, C.K., 1976.

2-49

cause of deafness (Murray, 1949, reported in Schein & Delk, 1974, p. 117). In many cases the stated cause of hearing loss was determined retrospectively after the hearing loss was discovered, and thus, for many cases of hearing defects of early onset, the cause is never determined. In addition, some adults may never have been told as children the nature of the illness which caused their deafness. Others may have received only a partial or an incorrect explanation (Schein & Delk, 1974, p. 117). Unilateral loss of congenital origin is typically discovered late and is rarely included in population statistics (Fisch, 1973). Further, as Gentile and Rambin (1973) point out, there is some indication that genetically related causes of deafness are understated.

The following table, compiled by Bensberg and Sigelman (1976, in press), summarizes the major surveys which have been conducted to determine the etiology of hearing impairment. As can be seen, there is wide variability depending upon the source and characteristics of the sample, the comprehensiveness of the evaluation and, probably the bias of the clinicians involved. If one were trying to average the findings of all of the studies, it would appear that approximately one-third seem to have a genetic component, one-third a post-traumatic or post-infectual etiology, and one-third an unknown etiology.

Two major sources of etiological data are NCDP (1974) and the Annual Survey of Hearing Impaired Children and Youth (Gentile & Rambin, 1973). Both employed questionnaires and/or interviews. We have previously discussed the procedure followed by NCDP. In the latter study, all special educational programs for the hearing impaired known to the Survey office (about 775) were asked to participate in the program. Reports were received from 555 educational programs (72 percent). In terms of enrollment, data were received for

41,109 students, a little more than 85 percent of those estimated to be enrolled in the special educational programs were invited to participate. For the most part, participating schools used data available from existing school records in completing the forms. However, three schools on their own initiative solicited this type of information from parents at the time of the survey. It should be noted that while NCDP includes both children and adults, the Annual Survey deals solely with children.

Hereditary-genetic. The Annual Survey reported that pre-natal causes were reported almost 700 times for each 1,000 students. These include maternal rubella, Rh incompatibility, heredity, trauma to mother during pregnancy, medication during pregnancy, complications of pregnancy, prematurity, trauma during delivery, all other specified prenatal causes, onset of loss at birth but cause not determined, and onset of loss at birth but cause not reported. If we look at just the first three causes we see that they were reported 256.7 times for each 1,000 students. Heredity alone was reported 74.8 times per 1,000 students. Among all the prenatal causes, Maternal Rubella has by far the highest rate of occurrence--147.8 per 1,000 students.

NCDP found, on the other hand, that 31.8 percent of their sample were born deaf or inherited their deafness. About a fourth of those born deaf stated that they inherited their hearing loss (7.6 percent of total) and about one in six implicated maternal rubella (5.2 percent). The largest portion--nearly 6 in 10 of those born deaf--could be no more specific than to note that they did not hear at birth.

TABLE 2-15

PERCENT DISTRIBUTION OF REPORTED CAUSES OF DEAFNESS, BY RACE AND SEX OF RESPONDENTS: UNITED STATES, 1972.

Cause	Total	White		Nonwhite	
		Male	Female	Male	Female
All Causes	100.0	100.0	100.0	100.0	100.0
Illness	35.0	35.9	40.9	41.5	31.9
Spinal Meningitis	9.7	10.8	8.3	14.1	7.1
Scarlet Fever	6.2	5.7	7.5	0.5	5.1
Measles	4.3	4.2	4.5	6.9	2.0
Whooping Cough	2.6	2.7	2.2	3.9	4.1
Other Illness	13.2	12.5	13.4	16.1	13.6
Accident or Injury	7.6	6.9	7.6	13.4	8.1
Birth Injury	2.5	2.6	2.2	2.9	4.1
Fall	3.1	3.0	3.7	1.0	1.0
Other Injury	2.0	1.3	1.7	9.4	3.0
Born Deaf or Heredity	31.8	33.1	32.6	19.6	27.1
Inherited	7.6	7.9	8.2	2.9	4.0
Mother Had Rubella	5.2	6.0	5.0	2.6	3.4
Born Deaf Other	19.0	19.2	19.4	14.1	19.7
Other Cause	7.5	7.8	6.6	5.9	13.2
Unknown	17.1	16.3	17.3	19.6	19.7

Source: Schein & Delk, 1974, p. 118.

TABLE 2-16

NUMBER OF REPORTED PRE-NATAL CAUSES OF HEARING LOSS PER 1000 STUDENTS ENROLLED IN PARTICIPATING SPECIAL EDUCATIONAL PROGRAMS FOR THE HEARING IMPAIRED BY CHRONOLOGICAL AGE: UNITED STATES, 1970-71 SCHOOL YEAR.

Pre-natal Causes of Hearing Loss	Chronological Age of Students						
	All Ages	Under 5 Years	5-7 Years	8-10 Years	11-13 Years	14-16 Years	17 Years & Over
Number of Students	41,109	2,527	10,216	7,529	9,509	6,759	4,569
	Number of Pre-natal Causes per 1,000 Students						
All Pre-natal causes	690.9	785.5	781.2	637.0	670.4	642.7	639.3
Total Specified causes	390.1	463.0	548.0	318.8	354.5	322.1	289.1
Maternal Rubella	147.8	212.1	361.9	57.9	106.2	28.7	44.6
Trauma To Mother During Pregnancy	6.2	5.9	6.9	6.5	5.0	6.5	5.9
Medication During Pregnancy	6.6	12.7	6.6	7.0	6.9	5.5	3.5
Prematurity	53.7	52.2	45.4	54.7	58.1	66.4	43.3
Rh Incompatibility	34.1	34.4	22.6	35.1	34.3	44.1	42.9
Heredity	74.8	79.1	53.5	81.8	74.6	92.6	82.1
Other Complications Of Pregnancy	24.2	33.2	21.0	25.8	25.2	26.5	17.9
Trauma During Delivery	22.3	17.0	15.1	25.9	22.9	28.7	24.5
All Other Specified Pre-natal Causes	20.5	16.2	15.0	24.0	21.2	23.1	24.3
Onset of Loss At Birth But Cause Not Determined	188.3	230.3	149.7	196.7	189.5	193.4	227.6
Onset of Loss At Birth But Cause Not Reported	112.5	92.2	83.6	121.5	126.4	127.2	122.6

Source: Gentile & Rambin (1973), p. 3

Prenatal environment. The Annual Survey found that per 1,000 students, trauma to mother during pregnancy was reported 6.2 times, medication during pregnancy was reported 6.6 times and other complications of pregancy, 24.2 times.

Natal environment. In the Survey, prematurity was found 53.7 times per 1000 students and trauma during delivery, 22.3 times. NCDP reported that birth injury accounted for 2.5 percent of all causes.

Trauma, accident, or injury. Per 1,000 students, 10.2 reported deafness due to trauma in the Annaul Survey. NCDP's data indicate that 7.6 percent of deafness was due to accident or injury; however, if we eliminate birth injury the number drops to 5.1 percent.

Disease. The Survey indicated that per 1,000 students meningitis was reported 49.1 times, mumps--8.5 times, measles--27.1 times, otitis media--22.5 times and fever--10.2 times. NCDP showed that illness accounted for 35 percent of hearing impairments. These include spinal meningitis (9.7%), scarlet fever (6.2%), measles (4.3%), whooping cough (2.6%) and other illness (13.2%).

Gentile and Rambin's data strongly implicate epidemics as a cause of loss among those born deaf. By plotting the relative number of births for various etiologies by birthmonth, a remarkable U-shaped distribution emerged for rubella and a relatively flat distribution for heredity. The seasonal pattern for rubella-deafened births corresponds to the periods of greatest incidence of communicable diseases. They promise further analyses to support their contention that other diseases, such as mumps and measles, may also be agents causing prenatal hearing defects. If they are correct, we may see a further reduction in the proportion of unknown causes. This, in turn, should lead to better control over birth defects due to infections of the mother during pregnancy.

TABLE 2-17

NUMBER OF REPORTED POST-NATAL CAUSES OF HEARING LOSS PER 1,000 STUDENTS ENROLLED IN PARTICIPATING SPECIAL EDUCATIONAL PROGRAMS FOR THE HEARING IMPAIRED BY CHRONOLOGICAL AGE: UNITED STATES, 1970-71 SCHOOL YEAR.

Post-natal Causes of Hearing Loss	Chronological Age of Students						
	All Ages	Under 5 Years	5-7 Years	8-10 Years	11-13 Years	14-16 Years	17 Years & Over
Number of Students	41,109	2,527	10,216	7,529	3,509	6,759	4,569
	Number of Post-natal Causes per 1,000 Students						
All Post-natal Causes	365.1	273.8	274.2	419.6	383.5	420.6	408.4
Total Specified Causes	181.4	156.3	122.3	206.8	185.8	222.1	216.2
Meningitis	49.1	72.4	40.8	59.1	44.1	45.6	53.6
Mumps	8.5	3.6	4.4	11.2	8.9	12.6	9.4
Measles	27.1	5.5	12.7	32.1	31.1	36.1	41.1
Otitis Media	22.5	21.0	15.7	30.2	23.5	27.2	17.5
Fever	15.3	21.4	13.1	15.7	14.5	18.2	13.4
Trauma	10.2	5.5	6.2	9.8	11.1	15.5	12.7
All Other Specified Post-natal Causes	48.7	26.9	29.4	48.7	52.6	66.9	68.5
Onset of Loss After Birth But Cause Not Determined	49.7	37.6	36.9	56.4	53.2	55.9	57.3
Onset of Loss After Birth But Cause Not Reported	134.0	79.9	115.0	156.3	144.5	142.6	134.8

Source: Gentile & Rambin (1973), p. 4

Age at Onset. As part of NCDP's definition of prevocational deafness, onset prior to 19 years is specified. The actual composition of the prevocationally deaf sample by age is positively skewed. Almost three-fourths of the total is prelingually deaf; i.e., lost hearing prior to three years of age. By contrast, not quite 12 percent became deaf at or after 6 years of age.

Gentile and Rambin (1973) found that almost 75 percent of the cases for which meningitis was identified as the principal cause occur prior to age three; also about 63 percent of the "Fever" cases occur prior to age three. On the other hand, only 31 percent of the "Mumps" ond "Otitis Media" cases occur prior to age three.

V. Life Functions

Inasmuch as deafness is characterized as a disorder of communication, it is this life function which is undoubtedly the most impaired. The deaf person is without a conventional linguistic system through which society communicates with him and he with society. In regard to social-attitudinal functions there is no clear-cut agreement among researchers. Some of the characteristics of the deaf noted are rigidity, emotional immaturity, the tendency to be neurotic and isolated, and in general to appear more poorly adjusted than the hearing. No simple relationships can be found in the area of mobility. Although it has been reported that the deaf are equal to the hearing in manual dexterity and most motor skills related to work, they may be somewhat retarded in the areas of motor speed, balance, and locomotor coordination. In the field of health, it appears that approximately one-third of the deaf have additional handicaps. Regarding cognitive-intellectual functions, it has been generally concluded that deaf persons possess average mental endowment. There is some disagreement, however, as to whether they have the same capacity for abstract and conceptual thinking.

Individual Life Functions

Mobility--Assessing the possible effect of deafness itself on motor behavior is indeed challenging. It is certain that considerably more is involved than just the factor of speed (Myklebust, 1960). An example is the shuffling gait which has been observed by those who work closely with the deaf (Myklebust, 1954). Individuals with high degrees of deafness typically shuffle their feet when they walk, and many educators attempt to train deaf children to lift their feet more normally. From observation such efforts seem not to have been successful as whatever causes the shuffling gait is not readily amenable to training. Furthermore, this characteristic gait is not limited to those with dysfunction of the semicircular canals. It can be observed in virtually all children having what is

referred to as profound deafness. This may reflect the primary nature of the problem as it indicates that hearing is used to monitor the sound or noise one makes when he walks. Apparently the hearing child learns not to shuffle because he hears and unconsciously reacts to the noise which it causes. When one does not hear the shuffling, the total organism is not made sufficiently aware of it; hence, the shuffling gait. This illustrates the subtle shifts which result from sensory deprivation and has implications for the alterations that must be considered when studying the relationships between deafness and motor functioning.

Two of the most common ways of studying motor capacities are the strength or force of the motor act, and the speed with which it is performed (Bills, 1948; De Jong, 1950). A number of investigators have indicated that speed concepts are difficult for deaf children. Hiskey (1955) suggested that speed tests should not be used in measuring their intelligence. Psychologists have referred to the sense of time and temporalness as being mainly dependent on hearing. There is evidence that motor speed might be reduced by deafness. However, as all such functions are complex, it should not be expected that this relationship is a simple one. Rather, it appears that such interaction depends on the nature of the task, on the motor functions involved, and how they are measured.

A third way commonly used to appraise motor function is through the study of handedness or laterality. A number of studies have shown that children having reading, speech, or other types of learning disorders often have disturbances of laterality (Morely, 1957). Associated with these difficulties is an above average incidence of left-handedness and mixed right and left handedness. There is an indication also that these deviations of laterality are more common in those having early life deafness.

There is considerable evidence from motor and neurological studies that integrity of motor behavior is closely associated with integrity of the central nervous system. Therefore, an individual having deafness might have motor disorders chiefly because of inner ear involvement or disturbances of the central nervous system; he might have both of these simultaneously. In such instances, he has organic damage causing both impaired hearing and motor disability. However, another major consideration is that deafness itself might alter motor functioning. In this case the shifts in motor behavior are secondary to the sensory deprivation.

Deaf persons are equal to the hearing in manual dexterity and most motor skills related to work (Boyd, 1967; Myklebust, 1960). Scores on the motor subtest of the General Aptitude Battery are among the evidence of this (Kronenberg & Blake, 1966). Most importantly, perhaps, competence of motor skills has been thoroughly demonstrated by studies of the deaf population in the world of work (Vernon, 1973). Here it is found that 87.5 percent are employed in manual occupations (Rainer, Altshuler, Kallmann & Deming, 1973).

TABLE 2-13

LIFE FUNCTION TABLE-HEARING IMPAIRED: MOBILITY

Statement of Problem	Dynamics	Source
Static equilibrium Inferior on Oseretsky Test of Motor Proficiency about 1 yr of retardation	deaf boys - various etiologies	Boyd, 1967
Locomotor coordination inferior (Oseretsky) 2 yr retardation at 10-yr level.	beginning at age 9	Boyd, 1967
Railwalking Test Inferior on locomotor coordination.	deaf children 7-15 yrs inferior in early life, show progressive maturation, but do not attain normal ability.	Myklebust, 1960
Loss of normal balance capacities.		Myklebust, 1960
Balance is negatively affected by inner ear defects. Inferior on speed of performance. Due to relevance of trial & error approach. Deaf made many more errors on speed tasks (Minnesota Spatial Relations Test)	deafness caused by meningitis. deaf males 12-21 yrs.	Myklebust, 1960 Long, 1932 Marsh, 1936 Myklebust, 1960
Inferior on speed rate of motor performance (Oseretsky)	deaf children 8-14 yrs.	Myklebust, 1960
Inferior in general static ability to use & maintain total balance capacitors (Oseretsky).		Myklebust, 1960
Atypical laterality - higher incidence of those who were left sided had mixed laterality (Harris)	deaf children 6-21 yrs.	Myklebust, 1960

Table 2-18 (cont'd)

Statement of the Problem	Dynamics	Source
High incidence of leftedness (Key-hole test)	deaf children 6-21 yrs.	Myklebust, 1960
Inferior on simultaneous movement ability to use one motor component in an activity while another component is used in another movement (Oseretsky)	deaf children 8-14 yrs.	Myklebust, 1960
Inferior on General Dynamic-generalized integration & coordination of motor activity (Oseretsky)	deaf children 8-14 yrs.	Myklebust, 1960
Many deaf individuals appear to be unable to lift their feet while walking, thereby causing a shuffling effect.	For those who suffer from profound deafness.	Myklebust, 1960

Health--The NCDP found that 1 of 3 prevocationally deaf persons sampled had an additional disability. The extra burden of the second disability may be far in excess of what it would be for the single disability because deafness multiplies the attendant problems (Schein, 1974). Obtaining medical care for a mild heart condition, for example, may become a problem because communication for physicians and nurses is often difficult. So even those conditions which may, by themselves, be innocuous can become severely disabling when occurring in combination with deafness (Schein & Delk, 1974, p. 122).

Within the NCDP sample the most frequent additional condition was asthma, which was reported by 8.3 percent of those sampled. Impaired vision was the next most prevalent health problem, affecting 3 percent of all deaf persons. The remaining conditions--neuropsychiatric disorders, arthritis, heart trouble, mental retardation, cerebral palsy, cleft palate, etc.--had frequencies of less than 3 percent (Schein & Delk, 1974).

Males tended to be somewhat healthier than females. Almost ten percent fewer males reported a health problem than did females. Females claimed far more asthmatics (10 percent versus 5.9 percent for males) and arthritis (2.8 percent versus 1.2 percent for males). Females also reported more visual problems (3.6 percent versus 2.7 percent for males). Though the proportions are tiny, the rates for cerebral palsy are worthy of note, 0.5 percent for females and 1.2 percent for males (Schein & Delk, 1974, p. 122).

"Nonwhites generally have a higher rate of additional disabilities. Asthma is far more prevalent among nonwhite than white males and females. Nonwhite females reported the largest percentages for heart trouble, mental retardation, and visual conditions. Nonwhite males reported the highest

TABLE 2-19

PERCENT DISTRIBUTION OF HEALTH CONDITIONS REPORTED OTHER THAN DEAFNESS BY RESPONDENTS 1 TO 64 YEARS OF AGE, BY RACE AND SEX: UNITED STATES, 1972.

Health Conditions	Both Sexes	Male			Female		
		Total	White	Nonwhite	Total	White	Nonwhite
All Conditions	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No Other Condition	66.6	69.9	71.3	58.0	63.2	64.3	54.4
Asthma	8.3	5.9	5.0	13.3	10.0	9.6	13.1
Vision	3.1	2.7	2.7	2.5	3.6	3.3	5.9
Neuropsychiatric Condition	2.8	1.0	.6	4.6	1.1	1.1	1.0
Arthritis	2.0	1.2	1.4	—	2.8	3.1	—
Heart Trouble	2.0	2.0	2.1	1.8	1.9	[illegible]	4.9
Mental Retardation	1.6	1.2	1.3	.9	1.9	1.5	4.9
Cerebral Palsy	.9	1.2	1.2	.9	.5	.5	1.0
Cleft Palate	.4	.4	.5	—	.4	.5	—
Other	15.1	14.4	13.9	17.9	15.9	15.7	17.7

Source: Schein & Delk, 1974, p. 123.

percentage of neuropsychiatric conditions" (Schein & Delk, 1974, p. 122).

When all ages up to 64 years are considered, the proportion of deaf persons reporting additional health conditions changes somewhat to 30 percent. Of these, two thirds have two or more conditions. Bear in mind that these rates are for the noninstitutionalized population. Persons so severely disabled as to require custodial care are not included, nor are the elderly (Schein & Delk, 1974, p. 122).

Studies of deaf children in elementary and secondary schools indicate that the next generation of deaf adults will also have a large proportion with multiple disabilities (Schein & Delk, 1974).

Mortality data do not reflect the morbidity picture. It is likely that, as with their deafness, many of the secondary disabilities to which prevocationally deaf persons fall victim are not life-threatening. Information supplied by the National Fraternal Society of the Deaf (major insurers of deaf persons) suggests that longevity in the deaf population is equal to or greater than that in the general population. Recognizing the nonrepresentativeness of the Fraternity's membership, however, more must be learned before this conclusion can be accepted (Schein & Delk, 1974).

The Annual Survey of Hearing Impaired Children and Youth, Gentile and McCarthy (1973) presented the number and types of additional handicapping conditions reported for 42,513 hearing impaired students enrolled in the participating special educational programs during the 1971-72 school year. In a form similar to that of the NCDP data, almost one-third of the students for whom data were obtained were reported to have one or more additional handicapping conditions. The three most frequently reported additional handicapping conditions were "Emotional or Behavioral Problems," "Mental Retar-

TABLE 2-20

PERCENT DISTRIBUTION OF NUMBER OF CONDITIONS REPORTED PER RESPONDENT: UNITED STATES, 1972.

Number of Conditions Reported	Number	Percent
Total	5945	100.0
No Condition	4168	70.1
One Condition	579	9.7
Two Conditions	814	13.7
Three or More	384	6.5

Source: Schein & Delk, 1974, p. 124.

dation" and "Visual Disorders" (Schein & Delk, 1974).

TABLE 2-21

LIFE FUNCTION TABLE - HEARING IMPAIRED: HEALTH

Statement of the Problem	Dynamics	Source
Asthma is a frequent condition.	8.3% of those sampled by NCDP reported asthma as a health problem making it the most frequent additional condition in the deaf.	Schein & Delk (1974)
Impaired vision	The second most prevalent health problem is impaired vision, affecting 3% of all deaf persons.	Schein & Delk (1974)
Deafness multiplies attendant problems of second disability.	The extra burden of a second disability may be far in excess of what it would be for the single disability because of complication of deafness.	Schein (1974)
High frequency of additional health conditions.	At all ages up to 65, the proportion of deaf persons with additional handicapping conditions is 30%. Of these two thirds have two or more conditions.	Schein & Delk (1974)
Inadequate medical care.	Because of difficulty in communicating symptoms to doctors and other health-care workers, deaf people's health problems may become severely disabling.	Schein & Delk (1974)
High frequency of additional handicaps in children - almost one-third have one or more. Most frequent are emotional or behavioral problems, mental retardation, and visual disorders, and perceptual-motor disorders.	More frequent in males; no general ethnic difference, although cerebral palsy is more frequent in whites and mental retardation and heart disorders are more frequent in non-Anglos. Additional handicaps associated with extent of hearing loss and onset at birth.	Gentile & McCarthy (1973).

Communication--Deafness has been characterized as a disorder of communication in the same sense that blindness has been called a disorder of mobility. The interference with communication pervades all aspects of a deaf person's life. A direct correlation exists between adequacy of communication in the deaf population and level of education as well as between adequacy of communication and income. However, the majority of deaf adults do not see themselves in need of further assistance in developing communication skills (Schein & Delk, 1974).

Difficulties of communication resulting from hearing loss in children leads to nonparticipation in group social and recreational activities which are available to normally hearing children. Since learning to function as a member of a group is essential in preparation for meeting life's challenges, the deaf child's communication problems have far-reaching consequences (Force, 1956).

TABLE 2-22

LIFE FUNCTION TABLE - HEARING IMPAIRED: COMMUNICATION

Statement of the Problem	Dynamics	Source
Low reading comprehension or functional illiteracy.	Less than 10% of the deaf population read at or beyond the 7th grade. The average deaf 16 year old has only attained the reading skills of the average fourth grader. Most deaf persons learn to communicate reasonably well using sign language but their formal language skills, as exemplified by reading comprehension and written communication, are very poor.	Bolton, (1973)
Poor or limited speaking ability.	Only 17% of group which completed 9 grades and 31% of those completing 9 to 12 grades rated their speech "good" and nearly 16% of the former and 9% of the latter reported no speaking ability.	Schein & Delk (1974)
Unwillingness to use verbal speech in store transactions.	Even though 7 out of 10 persons in the NCDP sample rated their speech "good" or "fair", only about 3 in 10 used speech alone in making a purchase.	Schein & Delk (1974)
Negative influence of inability to combine speech and manual gestures.	At work, the group which uses only manual communication or gestures do the worst financially while the highest average earnings occur in the speech-gesture group.	Schein & Delk (1974)

Table 2-22 cont'd.

Statement of Problem	Dynamics	Source
Low hearing thresholds	10%: 1968-69 10.7%: 69-70 16.3%: 70-71	Schein & Delk, 1974
Perceptual motor disorders	13.2% school age children 1968-69 13.8% school age children 1969-70 10% school age children 1970-71	" "
Visual Disorders		
Loss of perception of some degrees of noise	due to dysfunction of the outer or middle ear	
Mild to moderate loss of (rarely exceeds 60db or 70 db)	results from lesions of outer or middle ear	
Use of hearing aid can result in satisfactory hearing functioning	when lesions are in outer or middle ear	
Sensorineural impairment	results from dysfunction of the inner ear or the nerve pathway from the inner ear to the brain stem.	
Loss of tonal clarity	due to inner ear sensorneural	
Loss of loudness & sound	due to inner ear sensorneural impairment	
Clarity of words is distorted	due to inner ear sensorneural impairment	
Sound awareness impaired	due to inner ear sensorneural impairment	
Interference with the ability to perceive & interpret sound, particularly speech	due to central hearing loss	
Inability to hear faint or distant speech clearly	characteristic of an individual with "slight" hearing impairment	Illinois Commission on Children (1968)

Table 2-22 cont'd.

Statement of Problem	Dynamics	Source
Difficulty in understanding conversational speech at a distance of more than 5 feet	characteristic of an individual with a mild hearing impairment	Illinois Commission on Children (1968)
Conversational speech must be loud to be understood	characteristic of an individual with a marked hearing impairment	" "
Difficulty hearing any classroom discussion	characteristic of an individual with marked hearing impairment	
Deviations of articulation and voice	" "	" "
Deficient in language usage and comprehension	" "	" "
Limited vocabulary	" "	" "
Hearing limited to ability to hear loud voices about 7 feet from ear	characteristic of individuals with severe hearing impairment	" "
Hearing limited to ability to identify environmental sounds	" "	" "
Ability to discriminate vowels but not all consonants	" "	" "
Speech & language likely to deteriorate	characteristic of individuals with severe & extreme hearing impairment	" "
Aware of vibrations more than tonal patterns	characteristic of individuals with extreme hearing impairment	" "
Relies on vision rather than hearing as primary avenue for communication	" "	" "

Cognitive-Intellectual--Next to the auditory mechanism itself, undoubtedly the most studied characteristics of deaf persons is their intelligence. Over fifty studies of IQ dating back to the early 1900's demonstrate rather conclusively that intelligence is distributed essentially the same in the deaf population as it is among the nondeaf (Vernon, 1968). Corollary to these findings on intelligence, it has also been demonstrated that deaf persons have the same capacities for abstract thought as do the nondeaf (Furth, 1966; Vernon & Koh, 1960). This is most readily exemplified by the number of deaf professional mathematicians (Rose, 1967). Levine (1960) however, writes "subsequent studies tend to the conclusion that although the deaf as a group are of average mental endowment, functional lags exist in the areas of conceptual thinking and abstract reasoning".

The cognitive skills of deaf children and youth have been extensively investigated. The question of singular importance concerns the impact of auditory deprivation on intellectual development and functioning. Since deafness is almost synonymous with linguistic retardation (as evidenced by impoverished reading and writing skills), the question reduces to the relationship between linguistic facility and cognitive development. A large number of investigations conducted during the past 50 years have conclusively demonstrated that intellectual development and functioning are not dependent on language skills and that deaf persons possess normal intelligence. This is a very important conclusion because it implies that deaf persons have the potential to achieve to the same degree as hearing persons (Bolton, 1973).

Most comparative studies have concluded that there is no significant difference between deaf and hearing samples on learning tasks which do not require verbal mediation and, therefore, that language is not a necessary basis for abstract thinking and problem solving. Two points should be stressed: 1) Many studies have found differences favoring hearing subjects, but these

small differences reflect the cultural disadvantages and lack of "testwiseness" that penalize any minority group on psychological tests, and 2) strictly speaking, the conclusion is debatable because almost all deaf persons possess some minimal language skills (Blank, 1965; Bornstein & Ray, 1973).

Vernon (1968) reviewed over fifty studies dating back to the early 1900's and similarly demonstrated rather conclusively that intelligence is distributed essentially the same in the deaf population as it is among the nondeaf. He points out, however, that almost all of the investigations involve only samples of deaf children who work in school programs for the hearing impaired. (No study of the intelligence of the adult deaf has been reported in the literature). It is interesting to note that the studies done by investigators who were experienced in the psychological testing of deaf children at the time they did their work yielded results showing the deaf and the hearing more nearly equal in intelligence. As the experience of the examiner has strong direct bearing on the validity of test results, these studies must be given special emphasis in any consideration of the relative intelligence of deaf and hearing children on IQ measures. Vernon concludes that it is obvious that the range of intelligence among those with profound hearing loss is as great as the range among the normal hearing. Mean IQ values are also similar based on an overall consensus of the studies. However, some of the more recent investigations (Anderson, Stevens & Stuckless, 1966; Fresina, 1955; Vernon, 1966; Vernon, 1967a; Vernon, 1967b; Vernon, 1967c) suggest that there may be a disproportionately higher prevalence of low IQ's among those in schools for the deaf and hard of hearing when compared to expected values for IQ distributions. Similarly, studies of retarded populations suggest a higher prevalence of impaired hearing, but not necessarily deafness, than is found in nonretarded populations (Mathak, 1957; Koaman et al., 1963).

Vernon (1966, 1967a, b, c) also investigated the relationship of etiology of deafness to intelligence, and the changes in etiology growing out of medical advances in treatment offer possible explanations of this disproportionateness of low IQs. Based on these studies and on an understanding of the disease conditions causing deafness, it is apparent that many of the etiologies of profound hearing loss are also responsible for other neurological impairment which frequently results in lower intelligence. The point to be made is that the relationship, if any, between mental retardation and deafness is not causal but is due to the common etiology which brought about both the deafness and the retardation. The fact that certain of these etiologies and conditions - maternal rubella, purulent meningitis of early onset, premature birth, tuberculosis, meningitis, etc. - are responsible for an increasing percentage of the deaf school-age population suggests that there may be proportionately more retardation among deaf children in the future.

Vernon also noted that there is no relationship between the degree of hearing loss and IQ or age of onset of deafness and IQ. Exceptions were found in the case of certain etiologies, such as meningitis (Vernon, 1967).

In sum, the implication of the research of the last fifty years which compares the IQ of the deaf with the hearing and of subgroups of deaf children indicates that when there are no complicating multiple handicaps, the deaf and hard of hearing function at approximately the same IQ level on performance intelligence tests as do the hearing.

Salzberger & Jarrik (1969) conducted a comparative study of twins to assess the effects of deafness on measurable intellectual performance. They

found that early profound deafness is apt to curtail significantly intellectual performance as conventionally measured. Early onset of severe deafness lowers IQs on language dependent tests by approximately 20 points. Moreover, it should be emphasized that this estimate has been of the average rather than the maximum effect of deafness. Although the deaf obtain performance scores comparable to those of hearing subjects, they should not be expected to compensate to such a degree as to surpass the hearing group.

Furth (1966) conducted numerous investigations of the ability of deaf children and adolescents to master a variety of tasks in the areas of:

1) concept discovery and control - sameness, symmetry, and opposition, simulation, part-whole concepts;

2) memory and perception - visual memory span, gestalt laws of visual perception;

3) Piaget-type tasks - conservation of weight, conservation of amount of liquid; and

4) logical classification - classification transfer, conceptual performance, logical symbols, discovery and use. He found there are no consistent results in any of the areas of intellectual functioning. The only possible exception is the area of verbal mediation where curiously enough, the deaf perform in a manner consistently similar to the hearing and on Piaget's tasks in which deaf children are uniformly retarded but eventually reach a mature level of response. On discovery and shift tasks the deaf are at times behind, but frequently are not different from the hearing. On rote learning, in visual perception and immediate memory, there are no notable differences between the deaf and the hearing, nor did the deaf perform below the hearing on logical

classifications and in the use of logical symbols (Furth, 1966).

It seems then that the intellectual deficiency of deaf people, where it does exist, is associated with some specific situations which our investigations are beginning to highlight. The deaf are often insecure in an instructional situation of intellectual discovery and are accordingly slow in seeing what may be more readily obvious to the hearing peer. Furth states that he has not found that the deaf were incapable of understanding or of applying a principle as well as the hearing, once it was understood. But in some cases the deaf find it hard to discover the basis or reason for thinking. In general then, on tasks using a discovery principle the deaf lagged behind, but on tasks requiring comprehension and use of a principle they were equal to the hearing (Furth, 1966).

Furth (1966) holds that the deficient performance of the deaf on some intellectual tasks can be more adequately accounted for by experential than by linguistic deficiency, insofar as the former is far more varied and flexible and relates specifically to the particular area in which the deaf are observed to fail, while linguistic deficiency is almost general and could only awkwardly be related to an intellectual performance that was not generally retarded. By experential deficiency, we indicate socio-economic factors which unfavorably influence the deaf child's development. This deficiency becomes manifest in the intellectual area, not so much in any lack of basic capacity to understand or to apply principles, but rather in a sphere which may be called intellectual motivational and which concerns the spontaneous initiation or discovery of the inquiring mind.

In his conclusions Furth (1966) writes:

The deaf illustrate some of the effects of linguistic deficiency.

a) As a direct result of linguistic incompetence, the deaf fail at or are poor at all tasks which are specifically verbal or on a few nonverbal tasks in which linguistic habits afford a direct advantage.

b) As an indirect result of linguistic incompetence the deaf are frequently experentially deficient:

1) They do not know facts; they lack information.

2) They exhibit a minimal degree of intellectual curiosity.

3) They have less opportunity and training to think.

4) They are insecure, passive, or rigid in unstructured situations.

Some of these effects are more notable at younger age levels and disappear altogether in adulthood.

c) Apart from these tested effects, the basic development and structure of the intelligence of the deaf in comparison with the hearing is remarkably unaffected by the absence of verbal language. One can reasonably assume that the major area in which the deaf appear to be different from the hearing is in variables related to personality, motivation and values. If substantial differences are found, they will likely be due to experiential and social factors of home, school and the deaf community (Furth, 1966).

The experiential deficiency is tied to linguistic incompetence but it is proposed that this outcome would be avoidable if nonverbal methods of instruction and communication were encouraged both at home in the earliest years and in formal school education (Furth, 1966, pp. 226-227).

The difficulties in measuring intelligence nonverbally is a complex and involved problem. Nonlanguage mental tests must be used with those whose deafness dates from the pre-speech age if the deafness precluded the use of hearing in acquiring language. Although verbal and nonverbal tests correlate significantly, it is apparent that they measure different aspects of intelligence. Tests requiring verbal facility correlate most closely with those abilities required for learning academic materials. Nonverbal tests are not as useful for predicting this type of learning (Furth, 1966).

Memory

(1) Memory for patterns of movement. Hiskey (1955) found the deaf child inferior to the hearing on memory abilities. He explained this as a limitation in symbolic behavior. Blair (1957), however, compared deaf and hearing children in an investigation using matched pairs on the Knox Cube Test. The age range of the subjects was from seven to thirteen years. All children had intelligence levels within the normal range. He found a statistically significant difference between the deaf and the hearing on the test, in favor of the deaf. Costello (1957) used this test in a study of deaf and hard of hearing children and she, too, found a significant difference with the deaf being superior. In discussing this phenomenon Myklebust (1960) explains that a shift in perceptual organization must take place in order for the organism to sustain contact with reality and thereby assure the degree of psychological equilibrium required for adjustment. This is accomplished primarily through vision, the remaining distance sense. The individual with deafness from early life is of necessity dependent on visual clues which are irrelevant when hearing is normal. Therefore, his visual perceptual processes do not entail verbal symbolic behavior, they may develop to an extent not required when sensory capacities are normal. In other words, if the psychological process involved conforms to the basic monitoring mechanisms of the individual but not to those of the person with normal hearing, the deaf may show superiority.

(2) Memory for designs. Blair (1957) employing the matched pair technique, used the Graham Kendall Test to study this ability in the deaf. He found the deaf to be superior to the hearing. Interestingly, he observed that the hearing attempted to make associations such as, "This looks like a

box" or "This looks like a letter". Behavior of this type was not observed in the deaf, who simply observed and reproduced. Although complete explanation is difficult, it may be presumed that the deaf performed the task more concretely, their performance being at a more perceptual level.

(3) Motor memory. In his study of the growth of intelligence in deaf children, Fuller (1959) used a test of motor memory developed by Van der Lugt (1948) in which the subject traces raised mazes while blindfolded. He found the deaf superior to the norm for hearing children as provided by Van der Lugt. These norms were established on European children so direct comparison may be tenuous. Nevertheless, this study indicates that deaf children rely more on tactual-motor organization psychologically and hence, perform at a higher level of ability as compared to the hearing.

(4) Memory for object location. Blair (1957) used the method of allowing the child to observe the objects for twenty seconds then requiring him to place his set of identical objects in the same positions in which he had viewed them on a board. He found the deaf comparable to the hearing but not superior. These results were in agreement with those of Morsh (1936); however, in Morsh's study, there was a trend for the deaf to be superior. Apparently alteration of memory processes, which might result from deafness, does not affect the functions measured by this test. The deaf child observes, localizes, organizes, retains and reproduces the position of objects in a given space with equal facility as compared to the hearing.

(5) Span tests on which the deaf show inferiority. Blair (1957) used three types of span tests in his study of memory in deaf and hearing children. These were Picture Memory Span, Domino Span, and Digit Span. In each test one item was presented at a time; the memory task was to remember the specific series. The deaf were inferior to the hearing on all three measures, the differences being statistically significant.

Fuller (1959) also studied the visual digit span and his results are in close agreement with those of Blair. Moreover, both Blair and Fuller noted an unusual characteristic of deaf children on the Digit Span Test. The deaf did almost equally as well on digits reversed as they did on digits forward. Blair found that the mean score on reversed digits actually was higher than the mean score for digits forward. It seems that the processes of "recording", "organizing", and retaining might be different neurologically and psychologically.

TABLE 2-23

LIFE FUNCTION TABLE - HEARING IMPAIRED: COGNITIVE INTELLECTUAL

Statement of the Problem	Dynamics	Source
Lack of "testwiseness"	This penalizes the deaf on psychological tests.	Blank, 1965; Bornstein & Ray, 1973.
Many etiologies of profound hearing loss also result in lower intelligence.	The relationship between deafness and mental retardation is not causal but due to the common etiology which brought about both of these conditions.	Vernon, 1966 and 1967
Conventionally measured intellectual performance is significantly impaired.		Salzberger & Jarrik (1969).
Retarded verbal mediation	Deaf children are uniformly retarded in this area but eventually reach a mature level of response.	Furth, 1966
Slow in seeing what may be more readily obvious to the hearing peer.	Due to insecurity in instructional setting of intellectual discovery.	Furth, 1966
Difficulty in understanding the basis or reason for thinking.		Furth, 1966
Failure at tasks which are specifically verbal.	Linguistic incompetence also influences a few nonverbal tasks in which linguistic habits afford a direct advantage.	Furth, 1966
Indirect results of linguistic incompetence: Lack of knowledge of facts Lack of information Minimal degree of intellectual curiousity Lack of opportunity and training to think.	Mainly observed at younger age levels and sometimes disappear altogether in adulthood.	Furth, 1966
Memory: Impaired visual digit span on digits forward. (Picture Memory Span, Domino Span, and Digit Span)	Deaf children and teenagers.	Blair, 1957
Functional lag in the area of conceptual thinking.	During childhood, usually evaporates with the advent of adulthood.	Levin, 1966

Social-Attitudinal. Studies of the personality and social adjustment of deaf children and adults have yielded inconclusive and conflicting results. Berlinsky (1952), after reviewing 15 studies concluded, that while the deaf do show a few, albeit inconsistent differences in adjustment when compared to the hearing population, both groups appear to reach the same overall level of adjustment. On the other hand, Barker, et al. (1953) reviewed the same studies and reported that deaf children in residential schools appear to be more poorly adjusted, more emotionally unstable, and more neurotic than children with normal hearing. Due to inadequacies of many of these studies, they refused to draw any conclusions about deaf adults. DiCarlo and Dophin (1952) have also criticized many personality studies of deaf individuals especially for poor research design and inadequacy of measurement techniques.

A more recent study (Schuldt & Schuldt, 1972) considered 20 empirical personality studies of deaf children and concluded that deaf children manifest less adequate and more abnormal personality characteristics when compared to normal hearing children.

Levine (1963) also believes that many deaf people manifest weaknesses and deficits in ability to deal effectively and knowledgeably with complex problems of everyday life. Before concluding, however, that such traits are particularly characteristics of the deaf personality, it should be remembered that most deaf individuals grow up in a restricted environment, and as a consequence of their disability, tend to lead more constricted lives. Lacking opportunity for the development of many coping skills, it is not surprising that certain behavior patterns should be delayed in their appearance.

As a possible explanation for the emotional immaturity associated with deafness, Mykelbust (1964) suggests the "organic shift hypothesis" which he describes below:

> A sensory deprivation limits the world of experience. It deprives the organism of some of the material resources from which the mind develops. Because total experience is reduced, there is an imposition on the balance and equilibrium of all psychological processes. When one type of sensation is lacking, it alters the integration and function of all of the others. Experience is not constituted differently; the world, perception, conception, imagination, and thought have an altered foundation, a new configuration (1964, p. 1).

Assuming tht language is not only a significant variable in the development of social relationships and a facilitator of interaction, but an integral means by which sensory and other experience is internalized and stored, the proposed language deprivation associated with deafness could be accompanied by "a reciprocal restriction in ability to integrate experience" (Myklebust, 1964, p. 119). Following this line of reasoning, Myklebust (1964) believes that the personality of a deaf individual consequently might be "less structured, more immature, less subtle, and more sensorimotor in character" (p. 119).

Attitudes--Two aspects of attitude toward deafness may be delineated: (1) the actual attitudes held by hearing persons, and (2) the attitudes that deaf persons believe that hearing persons hold (perceived attitudes). Both aspects of attitude toward deafness are potentially detrimental to deaf people: actual attitudes may result in real barriers to education, employment, etc., while perceived attitudes influence the deaf person's motivation and estimate of self-worth. The available evidence indicates that deaf persons devalue deafness more than hearing persons and that they believe that hearing people hold more negative attitudes toward deafness than they actually do. These conclusions have clear implications for educators of deaf children and youth, as well as rehabilitation counselors working with deaf adults. The interested reader is referred to Schroedel and Schiff (1972) for a review of the research evidence.

According to Furth (1973) surveys in New York, in Baltimore, and in the Washington, D.C., metropolitan area demonstrate that on the whole deaf persons have a low crime rate and few driving violations (Schein, 1968). However, under the stress of unusual circumstances or of mental breakdown, impulsive and overly aggressive behavior may be a more typical reaction in deaf persons than other forms of aggressive behavior found in the hearing population. We can summarize this state of affairs in clinical language by stating that certain defense mechanisms that are widely available to the hearing persons and that are perhaps mainly derived from internalized verbal language may not be available to deaf people. On the other hand, deaf persons no doubt have some special defense mechanisms that allow them to withstand objective pressures (for example, school failure, the difficulty of communication) which would cause severe behavioral and emotional disorders in the average hearing person.

The Center for Research in Thinking and Language at the Catholic University of America undertook a study of deaf adolescents, in the course of which personality traits of these youths were investigated (cited by Furth, 1973). A behavioral inventory that tapped nine dimensions of personal interactions was constructed. Each dimension had a position and a negative pole and was represented by ten statements evenly divided between the two poles. Two observers who were well acquainted with the students were asked to concentrate on one person at a time and go over the ninety items, indicating whether a specific statement was true (or more true than false) or false (or more false than true) for the particular persons. This was done for 27 young deaf men around age 18-1/2 representing a typical sample of deaf persons entering adulthood. The control group consisted of 50

hearing boys at a residential school. Their mean age was two years younger than the deaf adolescents; however, they were comparable to the deaf boys in that they were in the last grades of high school. Table 13-24 summarizes the needs of the deaf and hearing impaired in the social-attitudinal life function.

TABLE 2-24

LIFE FUNCTION TABLE - HEARING IMPAIRED: SOCIAL ATTITUDINAL

Statement of the Problem	Dynamics	Source
More introverted More problems of neurotic type (Bernreuter P.I.)	Hard of hearing adults	Welles, 1932
More rigid in behavior (Rorshach)	Deaf children	McAndrew, 1948
Inferior in conceptual thinking, had limited interests and were emotionally immature compared to hearing (Rorshach)	Deaf children	Levine, 1956
Schizophrenic signs (Make a Picture Story Test)	Rubella deaf children and deafness from other etiologies.	Bindon, 1967
Males develop feelings of greater loss from their sensory deprivation as compared to females - saw hearing loss as being a greater handicap.	Hard of hearing adults at onset of symptoms	Myklebust, 1960
Social isolation - very few maintained primary identification with the normally hearing.	Hard of hearing adults at onset of symptoms	Myklebust, 1960
Feelings of severe isolation with detachment and aggressive attempts to compensate.	Hard of hearing adults	Myklebust, 1960
Inferior in social maturity (Violence social maturity scale) Inability to care for oneself or assist in the care of others.		Myklebust, 1960 Myklebust, 1954 Myklebust & Burchard. 1645 Bradway, 1937
Emotional immaturity. Personality constriction. Deficient emotional acceptability (Rorschach)	Early severe deafness	Levine, 1960

TABLE 2-24 cont'd.

Statement of the Problem	Dynamics	Source
Neurotic defenses - 1) overcompensation outgoing, striving, an exaggerated display of jovial behavior with great emphasis upon talking. 2) denial of hearing loss. 3) retreat from society 4) neurotic displacement of anxiety into the sphere of somatic preoccupation and complaints 5) neurotic exploitation of heavy loss (heavy aid - badge of invalidism)	Sudden hearing loss in adults	Knapp, 1948
Fear of being thought stupid, loneliness, insecurity in social situation.	Sudden hearing loss in adults	Knapp, 1948
Paranoid reactions - Deafness seems to be a powerful stimulus to any latent paranoid trend; may make an oversensititve person unduly suspicious of hostility in others.	Onset of symptoms in adult associated with depression.	Ramsdell, 1962
Lack of empathy - lack of understanding of and regard for the feelings of others.	Congenital deafness or acquired deafness in preverbal years.	Altshuler, 1969
Egocentric view of the world		Altshuler, 1969
Gross coercive dependence - adaptive approach is characterized by primitive riddance through action - preferred defensive reactions to tension and anxiety are typified by:		Altshuler, 1969
Uncertainty as to consequences of one's behavior - inadequate insight into a behavior and its consequences in relation to others and confused awareness of self in relation to others.		Altshuler, 1969

TABLE 2-24 cont'd.

Statement of the Problem	Dynamics	Source
Impoverished in relations - limitations in both emotional interchange and ability to abstract essentials from a situation interferes eith the establishment of firm object relations.	Congenital deafness or acquired deafness in preverbal years.	Altshuler, 1969
Emotional immaturity - fears are more unrealistic than those of hearing children. Lack of delay of gratification.	Onset of symptoms in childhood	Pintner, 1946
Psychoneurotic tendencies - higher incidence of behavior problems.	Onset of symptoms Congenital and acquired.	Springer, 1938 Springer & Roskow, 1938.
Less adequate social relationships.	Children	Myklebust & Burchard, 1945. Gregory, 1938
Inferior social grouping due to limitation in language - sought other deaf children as playmates.	Appears in preadolescent age - disappears thereafter	Nafin, 1933
More aggressive and competitive leader of the deaf depended more on admiration than on organization and direction of activities. Immature emotionally due to language limitation. (Piaget tasks)	Onset of symptoms Early life deafness	Pellet, 1938
More neurotic More introverted Less dominant (Bernreuter Pers. Inv.)		Pintner, Fusfeld, Branschwig, 1937
The hearing impaired child indulges less frequently in social and recreational activities.	Onset through adaption.	Force, 1956.
Under stress of unusual circumstances, the hearing impaired may become impulsive or overly aggressive	-"-	Furth, 1973.

VI. Functioning as a Member of Society

The literature provides information about functioning in the labor force and in the community by the hearing impaired.

Functioning as a Member of the Labor Force

The employment picture of the deaf and hearing impaired population is considerably brighter than that of many other disabled groups. A 1959 study conducted by Lunde and Bigman found a maximum unemployment rate of 6.3% among deaf persons. At the time of this survey, the overall unemployment rate in the United States was 5%. Considering that a certain portion of this sample was not in the labor force--that is, were students, sick or too disabled to work, or not seeking employment for other reasons--this figure is remarkedly low. Any generalizations drawn from this study about the employment status of the deaf population as a whole, however, should be tempered by the fact that the Lunde-Bigman sample was overwhelmingly biased in favor of whites. Only 3% of the sample were blacks.

Nonwhite deaf males reportedly have an unemployment rate nearly five times that of white deaf males. Nonwhite deaf females are also unemployed significantly more frequently than white deaf females. White deaf females are employed nearly twice as frequently as nonwhite deaf females (Schein & Delk, 1974).

As of 1972, less than three percent of deaf males were unemployed, a figure which compares favorably with the unemployment rates for all males for the same time period--4.9 percent. Deaf females are also more frequently unemployed than their hearing counterparts (1 out of 10 deaf females compared to 1 out of 15 hearing females) (Schein & Delk, 1974).

The proportion of prevocationally deaf persons in the labor force is slightly higher than the proportion of the general population. Fully two-thirds of the prevocationally deaf are in the labor force--approximately 83% of prevocationally deaf males and around 50 percent of the females (Schein & Delk, 1974). Table 2-24 shows the distribution of prevocationally deaf adults by labor force status.

TABLE 2-25

PERCENT DISTRIBUTION OF LABOR FORCE STATUS BY RACE AND SEX, RESPONDENTS 16-64 YEARS OF AGE: UNITED STATES, 1972.

Respondents' Sex and Race	N	Labor Force Status				Employment Status		
		Total	Not In Labor Force	In Labor Force			Unemployed	
				Deaf	Gen'l Pop.[a]	Employed	Deaf	Gen'l Pop.[a]
Males	2707	100.0	17.3	82.7	79.7	97.1	2.9	4.9
White	2427	100.0	16.1	83.9	79.6	97.8	2.2	4.5
Nonwhite	280	100.0	28.2	71.8	73.7	89.6	10.4	8.9
Females	2552	100.0	50.6	49.4	43.9	89.8	10.2	6.6
White	2286	100.0	50.4	49.6	43.2	90.5	9.5	5.9
Nonwhite	266	100.0	52.3	47.7	48.7	83.5	16.5	11.3

Source: Employment and Earnings, U.S. Department of Labor, Bureau of Labor Statistics (Vol. 20#9), March, 1974 in Schein & Delk, 1974, p. 75.

Deaf persons are currently holding positions in all industries, though most prevocationally deaf people work for private companies (as opposed to the federal government). Table 13-26 prepared by Schein & Delk (1974) delineates the principal occupations reported by deaf people in their comphrehensive survey undertaken in 1972. While the largest number of deaf people in this survey were machine operators or draftsmen, substantial numbers were employed as technicians and other professionals. There is some evidence, however, that the number of deaf persons in specific employment categories is not proportional to the numbers in the general population. For example, there are fewer deaf lawyers, doctors, and dentists than would be expected in the general population (Schein & Delk, 1974).

Williams and Sussman (1971) have also noted that many deaf people are underemployed--that is, working at positions that are not congruent with their capabilities. They report that almost 43% of deaf adults who have completed 13 years or more of school are working either as clerical, transit and nontransit operators, farm and nonfarm workers, and service or domestic workers (cited in Schein & Delk, 1974).

Vocational Rehabilitation data indicate that the hearing impaired and deaf clients have a high success ratio. For every unsuccessful client, there are approximately 8.21 successfully rehabilitated deaf clients. Within this general category, impairments other than deafness, however, appear to do best (a ratio of 10.82). Deaf people who are unable to speak do worst--a ratio of 4.60. The latter ratio, is reportedly higher than the average for all disabilities (3.52) (Schein & Delk, 1974).

That deaf persons are often the victims of negative employer attitudes has been evidenced by a number of studies (e.g., Rickard, et al., 1963; Williams, 1972). Rickard, et al., (1963) report that when employers were asked to rate

TABLE 2-26

PERCENT DISTRIBUTION OF PRINCIPAL OCCUPATIONS OF EMPLOYED RESPONDENTS 16 TO 64 YEARS OF AGE, BY SEX AND RACE: UNITED STATES, 1972.

	Male			Female		
	Total	White	Nonwhite	Total	White	Nonwhite
All occupations	100.0	100.0	100.0	100.0	100.0	100.0
Professional and Technical	9.2	9.5	6.1	8.1	7.6	12.1
Nonfarm Manager and Administrators	1.9	1.8	3.0	.5	.5	—
Sales	.3	.3	—	1.0	1.1	—
Clerical	8.1	8.3	6.1	27.7	28.6	19.4
Craftsmen	29.0	30.5	13.7	7.3	7.9	2.4
Operatives Nontransit	31.1	30.6	35.5	41.2	40.6	46.8
Operatives Transit	1.9	1.9	1.5	—	—	—
Laborers Nonfarm	8.2	7.5	15.2	2.4	1.9	7.3
Farmers and Farm Manager	1.2	1.3	—	—	—	—
Farm Laborers	1.1	1.2	—	.2	.3	—
Service Workers	8.0	6.9	18.8	11.3	11.2	12.1
Private Household Workers	.1	.1	—	.2	.3	—

Source: Schein & Delk, 1974, p. 82.

"applicants" by disability status, deafness was rated as worse than tuberculosis and wheelchair-bound, but better than epilepsy, ex-convict, and ex-mental patient. Williams (1972) asked 108 Minnesota employers about hiring persons with ten specific disabilities. Only 45% said they would readily hire a deaf person for a production job ("always" or "usually, but not always"). Asked about management jobs, the employers were even more negative toward hypothetical deaf applicants, 75 percent saying they would never or not usually hire a deaf person. Fifty one percent, however, said they would hire a deaf person for a clerical position. Williams and Sussman (1971) point out that this job "stereotyping" undoubtedly contributes to the underemployment of many deaf people.

Phillips (1973) elicited a number of employer stereotypes of deaf workers: safety risks, inflexible, difficult to train, and more. While the majority of the persons interviewed said they had no experience with deaf employers, most expressed a willingness to hire deaf persons.

The single largest employer of deaf people in the United States is the federal government. A study of employment practices in the civil service did not reveal any pattern of overt prejudice toward deaf employees (Bowe, Delk, & Schein, 1973).

Functioning as a Member of the Community

Schein and Delk (1974) report that nine out of ten deaf persons have parents who are neither deaf themselves or have no experience with deafness. Obviously, the deaf child of hearing parents faces more familial adjustment problems than the deaf child of deaf parents (Mindel & Vernon, 1971). Mindel and Vernon (1971) recommend enlightened and early professional intervention to help parents accept their child's impairment and learn how best to foster normal and adequate coping skills.

Deaf children of deaf parents apparently seem to acquire language more easily than deaf children of hearing parents. The most likely reason for this advantage is the deaf parents' ability to readily teach and community with their child in a language that is uniquely adapted to their needs. (Schlesinger & Meadow, 1972 cited in Schein & Delk, 1974).

Rainer, et al. (1969) report on a New York state study designed to elicit information from deaf persons regarding marriage, community participation, education and vocational adjustment. Information gathered in this study suggests that the deaf differ from their hearing peers with respect to the prevalence and nature of sexual experimentation and activity during adolescence. The study also found that among male deaf individuals, homosexual activity seems to be more common than heterosexual behavior, at least during the adolescent period (Rainer, et al., 1966).

Rainer et al., (1969) found significant differences in the marital status of congenitally deaf males and those with acquired deafness: two-thirds of the acquired deaf men were married compared with only one-third of the congenitally deaf. The authors suggest that attitudes toward one's own deafness and communication skills are undoubtedly associated with the figures cited above. They found that more respondents who are disturbed by their impairment remain single than those who appear to have made a successful adjustment.

Other interesting information obtained in the Rainer, et al (1969) study includes the finding that excellent communicators are more likely to report poor marital adjustment (including separation and divorce) than those with moderate communication skills. Persons whose ability to communicate is poorest were found to be least likely to marry, but once married, the likelihood of post-marital discord was about the same as that noted in the group of excellent communicators.

Schein and Delk (1974) report that 54.8% of the deaf males in their sample were married at the time of the study, and 40.3% had never been married. The remainder were widowed, separated, or divorced. A slightly greater percentage, 62.8%, of the females were married at the time of the study, 27.5% said they had never been married, and 9.7% were widowed, divorced, or separated. When race is taken into account, these rates vary widely. More white deaf males were married than nonwhite deaf males, and a similar trend was found among the females, with the majority of the discrepancy being accounted for by single persons rather than divorce or widowhood. The overall divorce rate was found to be nearly four percent (Schein & Delk, 1974).

Most deaf persons appear to prefer other deaf persons as marriage partners. Schein and Delk (1974) report that 81.5% of the males and 78.9% of the females in their sample indicated a preference for deaf partners and most married deaf persons had deaf spouses. A tendency to select hearing mates was noted among the better-educated deaf persons in the sample.

Rainer, et al. (1969) found that deaf marriages tend to produce fewer children than marriages of members of the hearing population. The authors point out that such data suggests some restriction in family size--consciously or unconsciously--by the deaf population. Most children born to deaf parents, however, have normal hearing, though the incidence of hearing impaired or deaf offspring increases if both parents are congentially deaf.

The New York State study reported by Rainer, et al. (1969) found that almost half of the respondents reported having hearing as well as deaf friends, but one third indicated friendships limited to deaf persons. There was no meaningful correlation between the likelihood of having friends and the individual's conception of the attitude of hearing persons toward the deaf. Almost one third of the deaf respondents felt that hearing people possess negative attitudes to-

ward the deaf, but as previously stated, many of these respondents also indicated having normal hearing friends.

Procuring insurance has not been a problem of any great magnitude for the deaf population. Schein and Delk (1974) found that most males in their study reported experiencing few problems in obtaining insurance of various types. Nonwhite males, however, had twice as many complaints as whites. Ten percent of the nonwhites said they paid extra premiums for life insurance; only three percent of the whites indicated a similar problem.

While the situation with regard to life and health insurance for the deaf is favorable, the case changes significantly when automobile insurance is considered. Sixteen percent of the Schein and Delk (1974) respondents felt they were either paying too much for automobile insurance or were required to pay exorbitant and prohibitive premiums for the coverage they wanted or needed. Schein (1968) has observed that from all available evidence, deaf drivers appear to be as safe, if not safer, than the general population.

VII. Technologies

1. Language and communication training--Generally one of three basic approaches are employed.

(a) Traditional oral method - stresses speech reading and skills of speech (O'Neill, 1968; DiCarlo, 1964; O'Neill & Oyer, 1961; Bruhn, 1949; Nitchie, 1950; Bunger, 1961; Nason, 1942; Morkovin, 1960).

(b) Amplified hearing method - focuses on listening as a learned skill (Fry, 1966).

(c) "Total communication" method - encourages the use of finger spelling and manual signs (Vernon & Koh, 1970).

2. Auditory training--concerned with training via the use of amplified sound such as with hearing aids, desk hearing aids, auditory training units (O'Neill, 1964; McConnell, 1968; Goldstein, 1939; Hudgins, 1953; Wendenberg, 1951; Ling, 1968 & 1964; Lewis, 1951; DiCarlo, Guberina, 1969; Martin & Pickett, 1968; Haspiel, 1969; Clark, 1957).

3. Telecommunications--enables deaf to gain additional benefit from television, telephones, etc. (Schein et al, 1974; Freebairn, 1974).

4. Electronic Communication--permit rudimentary signalling to deaf persons from remote locations (Schein & Freebairn, 1975).

5. Medical and Surgical Treatment

(a) Surgical techniques - available for such hearing disorders as conditions affecting the conducting apparatus as a result of infection, congenital defects and the disorder causing vertigo or Meniere's disease. Include Myringoplasty, tympanoplasty, fenestration surgery, stapes, and mobilization stapedectomy. Successful homograft transplants of complete middle-ear structures have been reported recently (Hearing, language and speech disorders, 1964 & 1969).

(b) Drugs - Small amounts of sodium fluoride appear to reabsorb the overgrowth of spongy tissue and restore hearing due to otossclerosis of the cochlea (Hearing, language and speech disorders, 1967). Chloramphenicol, used after surgery and in cases of chronic refractory otitis media, may actually cause deafness (Hearing, language and speech disorders, 1969).

(c) Preschool Screening for Rubella Damage (Hearing, language and speech disorders, 1967 & 1969).

(d) Radiotherapy (Hearing, language & speech disorders, 1964)

(e) Temporal Bone Bank Program - studies bequeathed inner ear structures for persons with long medical history of hearing problems (Hearing, language and speech disorders, 1967).

(f) Electrical stimulation - electrodes permanently implanted in the auditory nerve aid hearing (Hearing, language and speech disorders, 1967)

6. Educational Programs--Basically there are four types of organized educational programs for the deaf.

(a) Residential schools

(b) Day schools for the deaf

(c) Day class programs for the deaf--housed in same school buildings as accommodate the hearing

(d) Integrated classes with the hearing.

Other programs include home programs for teaching speech to very young deaf children; a few specialized programs for the child with two or more handicaps, one of which is deafness; a number of centers, both private and public, which offer diagnostic services or speech training (Advisory Committee on the Education of the Deaf, 1965).

7. Vocational Preparatory Services--Include vocational evaluation, vocational adjustment, skill training and job placement (Bolton, 1974).

RECENT LEGISLATION AFFECTING THE DEAF (1968)

Internal Revenue Code, Sec. 213, with regard to medical expenses, income tax deduction is limited to that portion of a taxpayer's expense which exceeds 3 percent of adjusted gross income. For example, tuition expense and the cost of employing a note taker for a deaf student at a regular college qualify for the medical expense deduction; however, the deaf student's room and board is not deductible. R.A. Baer Est. 26 TCM 170 (1967). Costs incurred in attending a training school (lip reading, sign language and speech) are deductible. Rev. Rule 68-212 (1968). Costs incurred at special training schools or hospitals, including meals, lodging, travel and tuition also qualify. Reg. 1.213-1 (eXuXa). Meals and lodgings qualify for a deduction if the resources of the institution for alleviating the handicap are principal reasons for the deaf person being there. Reg. 1.213-1 (e) (1) (iv).

National Technical Institute for the Deaf Act provides a residential facility for post-secondary technical training and education.

18A USCA 621 (1968) requires early and pre-school education of handicapped children.

Loan Service of Captioned Films and Educational Media for the Deaf Act was amended to substitute the words "handicapped persons" for "deaf persons". Captioned films, originally for the cultural and educational enrichment of the deaf, have proven so successful that persons with other handicaps will probably benefit by this amendment. 42 USCA 2491 (1965) (Grant, 1970).

VIII. Service Delivery

One of the chief problems in the area of service delivery is the severe shortage of qualified manpower. Approximately 1,500 interpreters are available to serve the deaf; most, however, have not received formal training. Clinical and consulting psychologists trained to work with the deaf are in extremely short supply. Only a few communities provide psychiatric service for this population. Those who are hospitalized usually do not receive therapeutic aid due to the lack of psychiatrists possessing the necessary communication skills. (Probably fewer than a dozen psychiatrists have been trained so as to be able to communicate with the deaf). Similarly, social workers and skilled evaluators to work at diagnostic, evaluative and work adjustment centers is extremely small.

Presently there are about 176 rehabilitation counselors specializing in work with the deaf. Most state vocational rehabilitation agencies have at least one counselor trained to serve the deaf and nearly half the states employ coordinators to develop statewide programs for this disability group.

TYPES OF FACILITIES

Mental Health Centers for the Deaf--Only 3 state mental health programs and one national program with limited intake presently exist for deaf persons. None are staffed to serve children. This situation is in part due to the scarcity of qualified personnel.

Community Service Programs for the Deaf--Aids deaf in using available routine service agencies. May provide interpreting services to agencies with deaf clients, diagnostic and evaluation services, counseling for deaf and their families, employment placement and adult education programs.

Rehabilitation Centers for the deaf--The Rehabilitation Acts of 1972 and 1973 include authorization for rehabilitation centers for deaf individuals to make it possible for those deaf persons who cannot be served at existing facilities to obtain the intensive diagnostic and training services that they need in order to achieve economic and social independence.

SERVICE ORGANIZATIONS

National Association of the Deaf--principle spokesman and advocate for the deaf consumer; sponsors national, regional state and local programs which elevate the level of services for the deaf; increases public awareness.

Council of Organizations Serving the Deaf--umbrella agency of organizations of and for the deaf; serves as an information center for dissemination of knowledge of deafness.

Registry of Interpreters for the Deaf--maintains national registry of professional interpreters; assists in the development and operation of state chapters.

Professional Rehabilitation Workers with the Adult Deaf--provides opportunity to cross disciplinary lines to share information and knowledge about deafness; issues quarterly journal, a newsletter and annual Deafness publication documenting federally supported research and training projects. (Adler & Williams, 1974).

SUPPORT FOR RESEARCH

NINDS, other Institutes within NIH, and other segments of HEW supply the most of all funding for research in human communication and its disorders. Slightly more than one-tenth of the NINDS research effort is in this direction, with expenditures exceeding $8,000,000. NINDS supported approximately one-third of all projects listed in the Science Information Exchance during 1975. The remaining Institutes sponsored another sixth of the total while other agencies of HEW funded another sixth. Almost all of the last

third of the projects are under the aegis of Federal agencies outside DHEW, especially the Armed Forces and Veterans Administration. Thus, only 7 percent of the projects known to the Science Information Service were not budgeted through Federal channels.

Private agencies and the academic community also support research on human communication disorders. Although the monetary expenditure is impossible to ascertain, one can be sure that the amount is sizeable.

SUPPORT OF TRAINING

NINDS spends almost $4,000,000 annually to support programs for training investigators in communicative sciences, both basic and applied. Other Federal agencies are expending at least twice this amount to foster programs whose primary aim is to prepare teachers, clinicians, and other service personnel. The non-Federal effort supplies approximately this much again; and it, too fosters preparation of a majority of service-oriented graduates.

Note: Communication disorders include disabilities other than just deafness such as speech processes and central communicative processes.

Detailed figures are available in Human Communication and its disorders: An overview (NINDS), 1970, pp. 26-42.

HEARING IMPAIRMENT BIBLIOGRAPHY

Adler, E.P., & Williams, B.R. Services to deaf people in the seventies. In R.E. Hardy and J.G. Cull (Eds.), Educational and psychosocial and aspects of deafness. Springfield, Ill.: Charles C. Thomas, 1974.

Advisory Committee on the Education of the Deaf. Factors in the selection of types of educational programs for deaf persons. Washington, D.C.: U.S. Department of Health, Education and Welfare, 1965, pp. 31-41.

Advisory Committee on the Education of the Deaf. Factors in the selection of types of educational programs for deaf persons. In R.L. Jones (Ed.), Problems and issues in the education of exceptional children. Boston: Houghton Mufflin Co., 1971.

Alexander Graham Bell Association for the Deaf, Inc. and The American University Development Education and Training Research Institutes. (Prepared by F. Atelsek and E. Macklin), Diversifying job opportunities for the adult deaf. (Research grant SRS 14-P-550-83-3/3/02) Washington, D.C.: Alexander Graham Bell Association, Inc. and the American University, 1971.

Altshuler, K.Z. Personality traits and depressions symptoms in the deaf. In J.D. Rainer, K.Z. Altshuler, F.J. Kallmann, & W.F. Deming (Eds.), Family and mental health problems in a deaf population. Springfield, Ill.: Charles C. Thomas, 1969, pp. 261-274.

Angelocci, A.A. A comparative study of vowel formants of deaf and normal-hearing eleven to fourteen year-old boys. Doctoral Dissertation, Wayne State University, 1962.

Annual survey of hearing impaired children and youth. Studies in achievement testing, hearing impaired students, U.S. 1971 Vital Health Statistics, Series D, No. 11. Washington, D.C.: Office of Demographic Studies, Gallaudet College, 1973.

Arthur, J.K. Employment for the handicapped. New York: Abington Press, 1967.

Barker, R.G., Wright, B.A., Meyerson, L.A., & Gonick, M.R. Adjustment of physical handicap and illness: A survey of physique and disability (Revised Edition). New York: Social Science Research Council, 1953.

Baroff, G.S. Patterns of socialization and community integration. In Rainer, J.D., Altshuder, K.Z., & Kallmann, F.J. (Eds.), Family mental health problems in a deaf population. Springfield, Ill.: Charles C. Thomas, 1969.

Bellefleur, P. Comments on European programs for the hearing impaired. Institute on Characteristics and Needs of the Hard of Hearing Child. Unpublished manual, Utah State University, 1967.

Bellefleur, P. Uses of electromagnetic induction (loop) for the hearing handicapped. Philadelphia, PA: Pennsylvania School for the Deaf, 1968.

Bender, L. Psychopathology of children with organic brain disorders. Springfield, Ill.: Charles C. Thomas, 1956.

Bensberg, G.J., & Sigelman, C.K. Definitions and prevalence. In L.L. Lloyd (Ed.), Communication assessment and intervention strategies. Baltimore, MD: University Park Press, 1976.

Berg, F.S. Definition and incidence. In F.S. Berg & S.G. Fletcher (Eds.), The hard of hearing child. New York: Grune & Stratton, 1970.

Berger, D.G., Holdt, T.J., & LaForge, R.A. (Eds.). Effective vocational guidance of the adult deaf. (Rehabilitation Services Administration, Rehabilitation Service, U.S. Department of HEW, Research Grant No. RD-2018-S). Eugene, Oregon: Oregon State Board of Control, Special Schools Division, 1972.

Berlinsky, S. Measurement of intelligence and personality of the deaf: A review of the literature. Journal of Speech and Hearing Disorders, 1952, 17, 39-54.

Best, H. Deafness and the deaf in the United States. New York: MacMillan, 1943.

Bills, A. Studying motor functions and efficiency. In T.G. Andrews (Ed.), Methods of psychology. New York: John Wiley and Sons, 1948.

Bindon, M. Make-a-Picture Story Test findings for rubella deaf children. Journal of Abnormal and Social Psychology, 1957, 55, 38.

Blair, I. A study of the visual memory of deaf and hearing children. American Annals of the Deaf, 1957, 102, 254.

Bolton, B. Introduction to rehabilitation of deaf clients. Fayetteville, AR: Arkansas Rehabilitation Research and Training Center, University of Arkansas, 1973.

Bowe, F.G., Delk, M.T., & Schein, J.D. Barriers to the full employment of deaf people in federal government. Journal of Rehabilitation of the Deaf, 1973, 6, 1-15.

Boyd, J. Comparisons of motor behavior on deaf and hearing boys. American Annals of the Deaf, 1967, 112, 598-605.

Bradway, K. Social competence of exceptional children. Journal of Exceptional Children, 1937, 4, 1.

Brill, R.G. Administrative and professional developments in the education of the deaf. Washington, D.C.: Gallaudet College Press, 1971.

Brookhauser, P.E., & Bordlay, J.E. Congenital rubella deafness: Pathology and pathogenesis. Archives of otolaryngology, 1973, 98, 252-257.

Buchwald, E. Physical rehabilitation for daily living. New York: McGraw-Hill Book Co., Inc., 1952.

Bureau of Labor Statistics. U. S. Department of Labor. Employment and earnings, 1974, 20(9).

Calvert, D. Speech sound duration and the sonant error. The Volta Review, 1962, 64, 401-402.

Carhart, R. Auditory training. In H. Davis and S. R. Silverman (Eds), Hearing and deafness. New York: Holt, Rinehart and Winston, 1962.

Carhart, R. Human communication--its disorders: An overview. (Monograph No. 10, p. 10). Bethesda, MD: National Institute of Neurological Diseases and Stroke, 1970.

Clarke, B. Use of a group hearing aid by profoundly deaf children. In A. Ewing, (Ed.), Educational guidance of the deaf child. Washington, D. C.: The Volta Bureau, 1957, pp. 128-159.

Cobb, H. V. The forecast of fulfillment. A review of research on productive assessment of the adult retarded for social and vocational adjustment. New York: Teachers College Association, 1972.

Committee on Medical Rating of Physical Impairment. Guides to the evaluation of permanent impairment of ear, nose, throat and related structure. JAMA, 1961, 19.

Committee on Prosthetics Research and Development of the Division of Engineering and Industrial Research. The control of external power in upper-extremity rehabilitation. Washington, D.C.: National Academy of Sciences, National Research Council, 1966.

Conference on Executive of American Schools for the Deaf. Report of the Conference Committee on Nomenclature. American Annals of the Deaf, 1938, 83, 1-3.

Cooper, L. The child with rubella syndrome. New Outlook for the Blind, 1969, 63, 290-298.

Costello, M. R. A study of speechreading as a developing language process in deaf and in hard-of-hearing children. Evanston, IL: Unpublished Doctoral Dissertation, Northwestern University, 1957.

Council on Physical Medicine and Rehabilitation. Report of the Council. Journal of the American Medical Association, 1955, 157, 1408-1409.

Craig, W. N., & Silver, N. H. Examination of selected employment problems of the deaf. American Annals of the Deaf, 1966, 111.

Crammatte, A. B. Deaf persons in professional employment. Springfield, IL: Charles C. Thomas, 1968.

Crammatte, A. B. Insurance problems of deaf people. In R. L. Meyer (Ed.), The deaf man and the law. Washington, D. C.: Council of Orgainzations Serving the Deaf, 1970.

Cull, J. G., & Covlin, C. R. Contemporary field work practices in rehabilitation. Springfield, IL: Charles C. Thomas, 1972.

Cull, J. G., & Hardy, R. E. Vocational rehabilitation: Profession and process. Springfield, IL: Charles C. Thomas, 1972.

Cull, J. G., & Hardy, R. E. Understanding disability for social and rehabilitation services. Springfield, IL: Charles C. Thomas, 1973.

Cull, J. G., & Hardy, R. E. Behavior modification in rehabilitation settings. Springfield, IL: Charles C. Thomas, 1974.

Cull, J. G., & Hardy, R. E. Rehabilitation techniques in severe disability. Springfield, IL: Charles C. Thomas, 1974.

Cutler, S. J. The totally deaf, the deafened, and the hard of hearing signer. In R. E. Hardy and J. G. Cull (Eds), Educational and psychosocial aspects of deafness. Springfield, IL: Charles C. Thomas, 1974.

Davis, H., & Silverman, S. R. Hearing and deafness. New York: Holt, Rinehart and Winston, 1960.

De Jong, R. The measurement of social competence. Minneapolis, MN: Educational Test Bureau, 1953.

de Raynier, J. P. Deafness in the world today. WHO chronicle, 1970, 24, (1).

Desmond, M. M., & Rudolph, A. The clinical evaluation of low-birth-weight infants with regard to head trauma. In C. R. Angle & E. A. Bering (Eds.), Physical trauma as an etiological agent in mental retardation. Bethesda, MD: National Institute of Neurological Diseases and Stroke, 1970.

DiCarlo, L. M. Some relationships between frequency discrimination and speech reception performance. Journal of Auditory Research, 1962, II, 47-59.

DiCarlo, L. M. The deaf. Englewood Cliffs, NJ: Prentice-Hall, 1964.

DiCarlo, L. M., & Dolphin, J. E. Social adjustment and personality development of deaf children: A review of the literature. Exceptional Children, 1952, 8, 111-118.

DiFrancesca, S. Academic achievement test results of a national testing program for hearing impaired students, United States, Spring, 1971. Washington, D.C.: Office of Demographic Studies, Gallaudet College, 1972.

Doctor, P. V. Summary statement of pupils and teachers in the United States, Directory Issue. American Annals of the Deaf, 1970, 115, 405.

Dorland's Illustrated Medical Dictionary. Twenty-third Ed., Philadelphia: W. B. Saunders, 1957.

Eagles, E., Wishik, S., Doerfler, L., Melnick, W., & Levine, H. Hearing sensitivity and related factors in children. Laryngoscope, 1963, (Special Monograph, no number).

Education of the deaf: A report to the Secretary of Health, Education, and Welfare. Washington, D.C.: U.S. Department of Health, Education, & Welfare, 1965.

Fisch, L. Epidemiology of congenital hearing loss. Audiology, 1973, 12, 411-425.

Force, D. Social Status of physically handicapped children. Journal of the International Council for Exceptional Children, 1956, 23 (3).

Ford, R. R. Diseases of the nervous system in infancy, childhood and adolescence (4th ed.). Springfield, IL: Charles C. Thomas, 1960.

Fraser, G. R. Profound childhood deafness. Journal of Medical Genetics, 1964, 1, 118-151.

Freebairn, T. Television for deaf people: selected prospects. New York: Deafness Research and Training Center, New York University, 1974.

Fricke, J. E. The status of education and training programs for speech pathology audiology. ASHA, 1969, 11.

Friedman, M., & Hall, M. Workshop on continuing education for deaf adults. New York: Deafness Research and Training Center, New York University, 1971.

Friedman, I., & Wright, M. I. Histopathological changes in the fetal and infantile inner ear caused by maternal rubella. British Medical Journal, 1966, 2, 20-23.

Frisina, D. R. Introductory remarks. American Annals of the Deaf, 1962, 107, 469.

Fry, D. B. The development of the phonological system on the normal and the deaf child. In F. Smith and G. A. Muller (Eds.), The Genesis of language: A psycholongestic approach. Cambridge, Mass.: The MIT Press, 1966.

Fuller, C. A study of the growth and organization of certain mental abilities in young deaf children. Evanston, IL: Unpublished Doctoral Dissertation, Northwestern University, 1959.

Furth, H. G. Thinking without language. New York: Free Press, 1966.

Furth, H. G. Deafness and learning: A psychological approach. Belmont, CA: Wadsworth Publishing Co., 1973.

Galloway, V. H. Legal rights of the deaf. In Proceedings of National Forum iii. Legal rights of the deaf. Washington, D.C.: Council of Organizations Serving the Deaf, 1970.

Gentile, A., & DiFrancesca, S. Academic achievement test performance of hearing impaired students. United States: Spring, 1969. Washington, D.C.: Office of Demographic Studies, Gallaudet College, 1969.

Gentile, A., & McCarthy, B. Additional handicapping conditions among hearing impaired students, United States: 1971-72. Vital Health Statistics, Series D, No. 14. Washington, D.C.: Office of Demographic Studies Gallaudet College, 1973.

Gentile, A., & Rambin, J. B. Reported causes of hearing loss for hearing impaired students. United States: 1970-71. Washington, D.C.: Office of Demographic Research Gallaudet College, 1973.

Gentile, A. Schein, J. D., & Haase, K. Characteristics of persons with impaired hearing. Vital and Health Statistics, Series 10, No. 35, 1967.

Glorig, A., & Roberts, J. Hearing levels of adults by age and sex. Vital and Health Statistics, Series 11, No. 11, 1965.

Goldstein, M. The acoustic method for the training of the deaf and hard of hearing child. St. Louis: The Laryngoscope Press, 1939.

Goldstein, R., McRandle, C. C., & Rodman, L. B. Site of lesion in cases of hearing loss associated with RH incompatibility: An argument for peripheral impairment. Journal of Speech and Hearing Disorders, 1972, 37, 447-450.

Goodhill, V. RH Child: Deaf or aphasic? Journal of Speech and Hearing Disorders, 1956, 2, 407-410.

Goodhill, V. & Guggenheim, P. Pathology, diagnosis and therapy of deafness. In L.E. Travis. (Ed.), Handbook of speech pathology and audiology. New York: Appleton-Century-Crafts, 1971.

Grant, J. A. The early detection of hearing loss. In R. E. Hardy and J. G. Cull (Eds.), Educational and psychosocial aspects of deafness. Springfield, IL: Charles C. Thomas, 1974.

Grant, J. W. Recent legislation affecting the deaf. In Proceedings council of Organizations Serving the Deaf. Proceedings of National Forum iii. Legal Rights of the Deaf. Washington, D.C.: Council of Organizations Serving the Deaf, 1970.

Gregory, I. A comparison of certain personality traits and interests in deaf and hearing children. Child Development, 1938, 9, 277.

Group work with hearing impaired children. Published report on a three-year demonstration project for deaf and hard hearing children. Chicago: Chicago Hearing Society, 1958 (out of print).

Guberina, P. The verbotinal method. Questions and answers. The Volta Review, 1969, 1969, 71, 213-224.

Guide for the evaluation of hearing impaired trans. American Academy of Opthalmology and Otolaryngology, 1959, 63, 236-238.

Hardy, M. P. Haskins, H. L., Hardy, W. G., & Shimiz, H. Rubella: Audiological evaluation and follow-up. Archives of Otolaryngology, 1973, 98, 237-245.

Hardy, W. G., & Bordley, J. E. Problems in diagnosis and management of the multiply handicapped deaf child. Archives of Otolaryngology, 1973, 98, 269-274.

Haspiel, G. S. Measurement of scoustic parameters for speech comprehension-transposition (Project No. RD-2575-S). Progress Report, Social Rehabilitation Service, 1969.

Hatfield, E. M. Estimates of blindness in the United States. The Sight-Saving Review, 1973, 43, 69-80.

Hearing, language and speech disorders. (NINDS Research Profiles No. 4, U.S. Public Health Service Publication No. 1156). Washington, D.C.: U.S. Government Printing Office, 1964.

Hearing, language and speech disorders. (NINDS Research Profiles No. 4, U. S. Public Health Service Publication No. 1156). Washington, D.C.: U.S. Government Printing Office, 1967.

Hearing, language and speech disorders. (NINDS Research Profiles No. 4, U.S. Public Health Service Publication No. 1156). Washington, D.C: U.S. Government Printing Office, 1969.

Heider, F., & Heider, G. M. Studies in the psychology of the deaf. Psychological Monograph, No. 242, 1941.

Hiskey, M. Nebraska Test of Learning Aptitude for Young Deaf Children. Lincoln: University of Nebraska, 1955.

Hodgson, W. R. Auditory characteristics of post-rubella impairment. The Volta Review, 1969, 71, 97-103.

Hudgins, C. The response of profoundly deaf children to auditory training. Journal of Speech and Hearing Disorders, 1953, 18, 273-288.

Human communication and its disorders: An overview. (NINDS Monograph No. 10). Bethesda, MD: U.S. Government Printing Office, 1970.

Illinois Commission on Children. A comprehensive plan for hearing impaired children in Illinois. Springfield, IL: Illinois Commission on Children, 1968.

Ingalls, T. H., & Klingberg, M. A. Congenital malformations: Clinical and community considerations. In J. M. Wolf & R. M. Anderson (Eds.), The multiply handicapped child. Springfield, IL: Charles C. Thomas, 1969.

Ivers, R. P. O'Connor, E., & Demarco, B. Vocational activities for the handicapped. Springfield, IL: Charles C. Thomas, 1974.

Jacob, A. T. How to use handicapped workers. New York: National Foreman's Institute, Inc., 1946.

Jones, R. L., & Stevenson, K. (Eds.). The deaf man and the world. Council of Organizations Serving the Deaf, National Forum II, 1969, 33-40.

Kelly, V. C. (Ed.). Practices of pediatrics. Hagerstown, MD: W. F. Prior, 1964.

Kerr, A. G., Smyth, G. D. L., & Cinnamond, M. J. Congenital syphilitic deafness. Journal of Laryngology and Otology, 1973, 83, 1-12.

Knapp, P. Emotional aspects of hearing loss. Psychosomatic Medicine, 1948, 10, 203-222.

Knower, F. H. Graduate theses in speech and hearing disorders. Journal of Speech and Hearing Disorders, 1957, 22, 104-112.

Knower, F. H. Graduate thesis: An index of graduate research in speech and cognate fields. Speech Monographs, 1968, 35, 348-399.

Kronenberg, H. H., & Blake, G. D. Young deaf adults: an occupational survey. Washington, D.C.: U.S. Department of HEW, Vocational Rehabilitation Administration, 1966.

Kwatny, E. & Zuckerman, R. (Eds.). Devices and systems for the disabled. Philadelphia: Krusen Center for Research and Engineering at Moss Rehabilitation Hospital, Temper University, Health Secession Center, 1975.

Lavos, G. The Chicago Non-verbal Examination: A study in retest characteristics. American Annals of the Deaf, 1950, 95, 379.

Levine, E. Youth in a Silent World. New York: New York University Press, 1956.

Levine, E. A. The psychology of deafness. New York: Columbia University Press, 1960.

Levine, E. S. Studies in Psychological evaluation of the deaf. The Volta Review, 1963, 65, 496-512.

Lewis, M. M. Infant speech: A study of the beginning of language. New York: Humanities Press, 1957.

Lieberman, P. Intonation, perception and language. Cambridge, Mass.: The MIT Press, 1967.

Lindsay, J. R. Histopathology of deafness due to postnatal viral disease. Archives of Otolaryngology, 1973, 98, 258-264.

Ling, D. Implication of hearing aid amplification below 300 cps. The Volta Review, 1964, 66, 723-729.

Ling, R. Three experiments on frequency transposition. American Annals of the Deaf, 1968, 113, 283-294.

Ling, T. M., & O'Malley, C. J. Rehabilitation after illness or accident. London: Bailliere, Tindall and Cox, 1958.

Lipscomb, D. M. How frequent are ear lesions and hearing defects among U.S. children? Clinical Pediatrics, 1973, 12, 125-126.

Lloyd, G. T. (Ed.). International research seminar on the vocational rehabilitation of deaf persons (Grant No. RD-2643-5). Washington, D. C.: U.S. Department of HEW, Social and Rehabilitation Service, 1968.

Lloyd, L. L. Operant conditioning with retarded children. In E. F. Walden (Ed.), Differential diagnosis of speech and hearing problems of mental retardates. Washington, D.C.: Catholic University of American Press, 1968.

Lloyd, L. L. Mental retardation and hearing impairment. In A. G. Norris (Ed.), PRWAD Deafness Annual (Vol. 3). Washington, D. C.: Professional Rehabilitation Workers with the Adult Deaf, 1973.

Lofquist, L. L. Vocational counseling with the physically handicapped. New York: Appleton and Century-Crofts, Inc., 1957.

Long, J. Motor abilities of deaf children. New York: Columbia University, T. C. Contribution to Education, No. 514, 1932.

Lunde, A. S. & Bigman, S.K. Occupational conditions among the deaf. Washington, D. C.: Gallaudet College, 1959.

Lunde, A. S. & Bigman, S.K. Occupational conditions among the deaf. Washington, D. C.: Gallaudet College, 1966.

Martin, E., & Pickett, J. Sensorineural hearing loss and upward spread of masking. Washington, D. C.: Gallaudet College, 1968.

McAndrews, H. Rigidity and isolation. A study of the deaf and the blind. Journal of Abnormal and Social Psychology, 1948, 43, 476.

McBride, E. D. Disability evaluation. Principles of treatment of compensabile injuries. Philadelphia: J. B. Lippincott Co., 1953.

McConnell, F. Philosophical framework for rehabilitation and habilitation of the hard of hearing. Proceedings of the Institute on Aural Rehabilitation. Supported by SRS 212-T-68. University of Denver, 1968, pp. 2-13.

Melnick, W. American National Standard Specifications for audiometers. ASHA, 1971, 13, 203-206.

Meyerson, L. A. A psychology of impaired hearing. In G.M. Cruickshank, Psychology of exceptional children and youth, (Second Ed.), 1963.

Miller, H. W. Plan and operation of the health and nutrition examination survey. Vital and Health Statistics, Series 1, No. 10 abb, 1973.

Mindel, E. D., & Vernon, M. They grow in silence. Silver Spring, MD: National Association of the Deaf, 1971.

Morley, D. An analysis by sound spectograph of intellegibility variations of consonant sounds spoken by deaf persons. Doctoral Dissertation, University of Michigan, 1949.

Morley, E. The development and disorders of speech in childhood. Edinburgh: Livingstone, 1957.

Morsh, J. Motor performance of the deaf. Community Psychology Monographs, No. 66, 1936.

Murphy, K. P. Tests of abilities and attainments. In A. Ewing (Ed.), Educational guidance and the deaf child. Washington, D. C.: The Volta Bureau, 1957.

Murray, N. E. Deafness following maternal rubella. Medical Journal of Australia, 1949, 1, 126-130.

Myklebust, H. R. Towards a new understanding of the deaf child. American Annals of the Deaf, 1953, 98, 496.

Myklebust, H. R. Auditory disorders in children. New York: Grune and Stratton, 1954.

Myklebust, H. R. The psychology of deafness. Sensory deprivation, learning, and adjustment. New York: Grune and Stratton, 1960.

Myklebust, H. R. Psychology of deafness, (2nd Ed.). New York: Grune and Stratton, 1964.

Myklebust, H. R., & Burchard, E. M. L. A study of the effects of congenital and adventitious deafness on the intelligence, personality, and social maturity of school children. Journal of Educational Psychology, 1945, 36, 321.

Nafin, P. Das soziale vertialten caub stummel schulkinder. Konigsberg, Unpublished Thesis, 1933.

Naiman, D. W., & Mashikan, H. S. Handbook for staff development in residential schools for deaf children. New York: Deafness Research on Training Center, New York University, 1973.

National Center for Health Statistics. Origin, Program and Operation of the U.S. National Health Survey. Vital and Health Statistics, Series 1, No. 1, 1965.

National Health Survey (1935-36). Preliminary reports: Hearing Study Series Bulletin No. 1. Washington, D. C.: U.S. Public Health Service, 1938.

National Institute of Neurological Diseases and Stroke. Human communication and its disorders: An overview. Bethesda, MD: United States Department of Health, Education, and Welfare, 1970.

Ojala, P., Timo, V., & Elo, O. Rubella during pregnancy as a cause of hearing loss. American Journal of Epidemiology, 1973, 98, 395-401.

Oleron, P. Conceptual thinking of the deaf. American Annals of the Deaf, 1953, 98, 304.

O'Neill,J.J. Spreading - significance and usage for children and adults. Proceedings of the Institute on Aural Rehabilitation (Supported by SRS 212-T-68). University of Denver, 1968, p. 45-46.

O'Neill, J. J. The hard of hearing. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1965.

Patterson, C. H. Readings in rehabilitation counseling. Champaign, IL: Strupes Publishing Co., 1968.

Pauls, M. D. Speechreading. In H. Davis and S. R. Silverman (Eds.), Hearing and Deafness. New York: Holt, Rinehart, and Winston, Inc., 1962.

Pellet, R. Des premieres perceptions du concret a la conception de l'abstrait. Lyon: Bosc Freres, 1938.

Phillips, J. B. A survey of career opportunities for the deaf. M. Ed. Dissertation, University of Rochester, 1973.

Pintner, R. The Pintner Nonlanguage Mental Test. New York: Columbia University, Bureau of Publications, 1929.

Pintner, R., Fusfeld, I., & Brunshwig, L. Personality tests of deaf adults. Journal of Genetic Psychology, 1937, 51, 305.

Pintner, R., & Paterson, D. G. A scale of performance tests. New York: Appleton-Century-Crofts, 1923.

Pintner, R. & Reamer, J. F. Learning tests with deaf children. Psychological Monograph, No. 20, 1916.

Pintner. R., & Reamer, J. F. A mental and educational survey of schools for the deaf. American Annals of the Deaf, 1920, 65, 451.

Post, R. H. Hearing acuity variation among negroes and whites. Eugenics Quarterly, 1964, 11, 65-81.

Proceedings on the conference on the collection of statistics of severe hearing impairments and deafness in the United States. (NINDS, U.S. Public Health Service Publication No. 1227). Bethesda, MD: U.S. Government Printing Office, 1964.

Rainer, J. D., & Altshuler, K. Z. Expanded mental health care for the deaf: Rehabilitation and prevention. New York: New York State Psychiatric Institute, 1976.

Rainer, J. D., Ahshuler, K. Z., & Kallmann, F. T. Psychotherapy for the Deaf. In J.D. Rainer, K. Z. Ahshuler, F. J. Kallmann, & W. E. Deming (Eds.), Family and mental health problem in a deaf population. Springfield, IL: Charles C. Thomas, 1969, pp. 182-192.

Rainer, J. D., Altshuler, K. Z., Kallmann, F. J., & Deming, W. E. (Eds.). Family and mental health problems in a deaf population. New York: Department of Medical Genetics, New York State Psychiatric Institute, Columbia University, 1969.

Rainer, J. D., Altshuler, K. Z., Kallmann, F. J., & Deming, W. E. (Eds.). Family and mental health problems in a deaf population. Springfield, IL: Charles C. Thomas, 1969.

Rath, J. A., & Eddy, R. M. Rehabilitation for the unwanted. New York: Atherton Press, 1967.

Rawlings, B. Characteristics of hearing impaired students by hearing status, United States: 1970-71. Washington, D.C.: Office of Demographic Studies, Gallaudet College, 1973.

Rawlings, B., & Gentile, A. Additional handicapping conditions, age of onset of hearing loss and other characteristics of hearing impaired students, United States, 1968-1969. Washington, D.C.: Office of Demographic Studies, Gallaudet College, 1970.

Rickard, T. E., Triandis, H. C., & Patterson, C. H. Indices of employer prejudice toward disease applicants. Journal of Applied Psychology, 1963, 47, 52-55.

Roberts, J., & Bayliss, D. Hearing levels of adults by race, religion, and areas of residence. Vital and Health Statistics, Series 11, No. 26, 1967.

Roberts, J., & Federico, J. V. Hearing sensitivity and related medical findings among children. Vital and Health Statistics, Series 11, No. 114, 1972.

Robinson, G. J. Pediatrics and disorders in communication: I. Hearing loss in infants and young preschool children. Volta Review, 1964, 66, 314-318.

Robinson, H. B., & Robinson, N. M. The mentally retarded child: A psychological approach. New York: McGraw-Hill, 1965.

Rosenstein, J., & Lerman, A. Vocational status and adjustment of deaf women. New York: Lexington School for the Deaf, 1963.

Safety Standards. U.S. Department of Labor, 1964.

Salmon, F. C. and Salmon, C. F. Rehabilitation center planning. An architectural guide. University Park, Penn.: The Pennsylvania State University Press, undated.

Salzbeige, R. M., & Jarvik, L. F. Intelligence tests in deaf twins. In J. D. Ranier, K. Z. ALtshuler, & F. J. Kallmann (Eds.), Family and mental health problems in a deaf population. Springfield, IL: Charles C. Thomas Publisher, 1969.

Sataloff, J. How to sell top management on hearing conservation. Occupational Hazards, 1966, 28, 23-27.

Schein, J. D. Factors in the definition of deafness as they relate to incidence and prevelance. In Proceedings of the Conference on the Collection of Statistics of Severe Hearing Impairments and Deafness in the United States, 1964. (U.S. Public Health Service Publication No. 1227). Washington, D.C.: U.S. Government Printing Office, 1964.

Schein, J. D. The deaf community. Washington, D.C.: Gallaudet College Press, 1968.

Schein, J. D. Social services and the deaf client. In Proceedings of National Forum iii. Legal rights of the deaf. Washington, D.C.: Council of Organizations Serving the Deaf, 1970.

Schein, J. D. Analysis of factors affecting undergraduate enrollments at Gallaudet College. New York: Deafness Research and Training Center, New York University, 1972.

Schein, J. D. Hearing disorders. In L. T. Kurland, J. F. Kurtzke, & I. E. Goldberg (Eds.), Epidemiology of neurologic - sense organ disorders. Cambridge, MA: Harvard University Press, 1973.

Schein, J. D., & Delk, M. T. The national census of the deaf population. Deafness Annual, 1973, 3, 183-193.

Schein, J. D., & Delk, M. T., Jr. The deaf population of the United States. Silver Spring, MD: National Association of the Deaf, 1974.

Schein, J. D., & Freebairn, T. Evaluation of an electronic system for promote signalling of deaf and deaf-blind persons. In E. Kwatny and R. Zuckerman (Eds.), Devices and system for the disabled. Philadelphia: Temple University, 1975.

Schein, J. D., Freebairn, T., Suna, B., & Hooker, S. Television for deaf audiences. Deafness Annual, 1972, 2, 71-80.

Schein, J. D., & Roy, H. L. Some physical characteristics of the deaf college student. Washington, D.C.: Office of Psychological Research Gallaudet College, 1961.

Schick, H. F. A performance test for deaf children of school age. The Volta Review, 1934, 34, 657.

Schlesinger, H. S., & Meadow, K. P. Sound and sign. Childhood deafness and mental health. Los Angeles: University of California Press, 1972.

Schroedel, J., & Schiff, W. Attitudes towards deafness among several deaf and hearing populations. Rehabilitation Psychology, 1972, 19, 59-70.

Schuldt, W. J., & Schuldt, D. A. A review of recent personality research on deaf children. In E. P. Trapp, & P. Himelstein (Eds.), Readings on the exceptional child (Rev. Ed.). New York: Appleton-Dentury-Crofts, 1972.

Seal, A. G. Thirty wonderful years. A program of service to the deaf and hard of hearing. Baton Rouge, LA: Beltone Electronics Corporation, 1973.

Shephard, J. H. Civil law. In Proceedings of National Forum iii. Legal rights of the deaf. Washington, D.C.: Council of Organizations Service the Deaf, 1970.

Siegal, M., Fuerst, J. T., & Peress, N. S. Fetal mortality in maternal rubella: Results of a prospective study from 1957-64. American Journal of Mental Deficiency, 1959, 64, 444-459.

Silver, N. H. Employment practices in industry. Journal of Rehabilitation of the Deaf, 1970, Monograph No. 2, 10-14.

Silverman, S. R., & Taylor, S. G. The choice and use of hearing aids. In H. Davis and S. R. Silverman (Eds.), Hearing and Deafness. New York: Holt, Rinehart, and Winston, 1962.

Simon, P. Healthy group experience for the handicapped child. The Educational Press Bulletin, Springfield, Il: March, 1955.

Special Education: Directory 1965-1966, and Statistical Report 1964-1965. Springfield, IL: 1966.

Spriesterback, D. C., Dickerson, D. R., Fraser, F. C., Horowitz, S. L., Williams, B. J., Paradesi, J. L., & Randal, P. Clinical research in cleft lip and cleft palate: The state of the art. Cleft Palate Journal, 1973, 10, 113-165.

Springer, N. N. A comparative study of psychoneurotic responses of deaf and hearing subjects. Journal of Educational Psychology, 1938, 29, 459.

Springer, N. N. A comparative study of intelligence of a group of deaf and hearing children. American Annals of the Deaf, 1938, 83, 183.

Springer, N. N. A comparative study of behavior traits of deaf and hearing children in New York City. American Annals of the Deaf, 1938, 83, 255.

Springer, N. N., & Roslow, S. A further study of the psychoneurotic responses of deaf and hearing children. Journal of Educational Psychology, 1938, 29, 590.

Stabler, A. Underemployment. In R. L. Jones, & K. Stevenson (Eds.), The deaf man and the world. Council of Organizations Serving the Deaf, National Forum II, 1969, pp. 33-40.

Stewart, M. G. The U. S. economy in 1980: A preview of BLS projections. Monthly Labor Review, April, 1970, 3-34.

Streng, A., & Kirk, S. A. The social competence of deaf and hard of hearing children in a public day school. American Annals of the Deaf, 1938, 83, 244.

Symposium on research and utilization of educational media for teaching the deaf. Up date 74: A decade of progress. (Sponsors: National Center on Educational Media and Materials for the Handicapped, Ohio State University. Department of Educational Administration, Teachers College, University of Nebraska. Midwest Regional Media Center for the Deaf). Lincoln, NB: Nebraska Center for Continuing Education, 1974.

Templin, M. C. The development of reasoning in children with normal and defective hearing. Minneapolis: University of Minneapolis Press, 1950.

Texas School for the Deaf and Texas Education Agency. An employment analysis of deaf workers in Texas. Austin, TX: authors, 1972.

Treacy, L. A study of social maturity in relation to factors of intelligence in acoustically handicapped children. Unpublished thesis, Northwestern University, 1952.

Van der Lugt, M. Psychomotor Test Series for Children. New York: New York University Press, 1948.

Vernon, M. Multiply handicapped deaf children. A study of the significance and causes of the problem. Unpublished doctoral dissertation, Glaremont Graduate School and University Center, 1966.

Vernon, M. Characteristics associated with post-rubella deaf children: Psychological, educational, physical. The Volta Review, 1967, 69, 176-185.

Vernon, M. Meningitis and deafness: The problem, its physical, audiological, psychological and educational manifestations in deaf children. Larynogoscope, 1967, 77, 1856-74.

Vernon, M. Psychological, education and physical characteristics associated with post-rubella deaf children, The Volta Review, 1976.

Vernon, M. RH factor and deafness: The problem, its psychological, physical and educational manifestations. Journal of Exceptional children, 1967, 34, 5-12.

Vernon, M. Tuberculosus meningitis and deafness: A review of the literature and an discussion of related clinical cases. Journal of Speech and Hearing Disorders, 1967.

Vernon, M. Sociological and psychological factors associated with hearing loss. Journal of Speech and Hearing Research, 1969, 12, 541-563.

Vernon M., & Koh, S. D. Effects of early manual communication on achievement of deaf children. American Annals of the Deaf, 1970, 115, 527-536.

U.S. Bureau of the Census. The blind and deaf-mutes in the United States, 1930. Washington, D.C.: U.S. Government Printing Office, 1931.

U.S. Bureau of the Census. Census of Population, 1970, General Social and Economic Characteristics, Final Report. PC (1)-C1 U.S. Summary. Washington, D.C.: U.S. Government Printing Office, 1972.

U.S. Army AR 40-530-55. Auditory evaluation of members on active duty. Cited in H. Davis, & S. R. Silverman (Eds.)., Hearing and deafness. New York: Holt, Rinehart and Winston, 1960.

Walsh, T. E. The surgical treatment of hearing loss. In H. Davis, & S. R. Silverman (Eds.) , Hearing and deafness. New York: Holt, Rinehart, and Winston, 1962.

Watson, T. J. The education of hearing-handicapped children. Springfield, IL: Charles C. Thomas, 1962.

Webb, C., Kinde, S., Weber, B., & Beedley, R. Incidence of hearing loss in institutionalized mental retardates. American Journal of Mental Deficiency, 1966, 70, 563-568.

Weber, H. J., McGovern, F. J. & Zink, D. An evaluation of 1,000 children with hearing loss. Journal of Speech and Hearing Disorders, 1967, 32, 343-354.

Webster's Third New International Dictionary of the English Language, Unabridged. Springfield, MA: G. & G. Merriman, 1964.

Welles, H. Measurement of certain aspects of personality among hard of hearing adults. New York: Columbia University, T. C. Contributions to Editors, No. 545, 1932.

White House Conference on Child Health and Protection. Special Education the Handicapped and the Gifted: Report on the Committee on Special Classes. Section III, Education and Training. Vol. III-F. New York: Appleton-Century-Crofts, 1931.

Wiedenburg, C. Auditory training of deaf and hard of hearing children. Acts Otoloyngologica, Supplementum, 1951, 94, 1-129.

Wright, R. The abstract reasoning of deaf college students. Unpublished doctoral dissertation, Northwestern University, 1955.

Wright, B. A. Psychology and rehabilitation. Washington, D. C.: American Psychological Association, 1959.

Williams, B. R., & Sussman, A. E. Social and psychological problems of deaf people. In A. E. Sussman, & L. G. Steward (Eds.), Counseling with deaf people. New York: Deafness Research and Training Center, New York University, 1971.

Williams, C. A. Is hiring the handicapped good business? Journal of Rehabilitation, 1972, March-April, 30-34.

Wooden, H. Z. Deaf and hard of hearing children. In L. M. Dunn, Exceptional children in the schools. New York: Holt, Rinehart and Winston, 1963.

Zamir, L. J. Expanding dimensions in rehabilitation. Springfield, IL: Charles C. Thomas, 1969.